

**NATURAL AREA RESERVES SYSTEM**  
Department of Land and Natural Resources  
State of Hawaii

A BASELINE SURVEY OF AHIHI BAY

By the University of Hawaii  
Marine Option Program

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## ABSTRACT

Ahihi Bay is located on the western side of Cape Kinau, the southernmost point of the island of Maui. It is one of two designated Natural Area Reserves under the jurisdiction of the State of Hawai'i Department of Land and Natural Resources. Removal of marine organisms is not permitted.

On May 26, 1985, members of the University of Hawaii Marine Option Program (MOP) performed a baseline study of Ahihi Bay. This was the culmination of the 1985 MOP Maui Transecting Workshop.

The survey team established five 100-meter transect sites around the bay. The depths of these areas ranged from the shoreline to 8.45 meters. The bay floor off the southern point was deepest, while both sides of the bay were slightly shallower. The central transects of the bay lay on the shallow reef flat.

According to the point quadrat method, exposed coral rubble was visible on 51.64 per cent of the substrate. Sand covered almost 10 per cent of the bottom. Corals (25.82%) and calcareous algae (4.34) were the of the nonmotile organisms.

The most dominant of the ten observed coral species were Porites lobata and Pavona varians, which covered 5.9% and 5.12% per cent of the areas transected (respectively), using the grid quadrat method. Porolithon gardineri was the most frequently observed algae. One colony of the zoanthid Polythoa tuberculosa was noted.

In the waters above the 5,000 square meter transected area, the team observed 1,970 individuals. In all, 66 species were observed. The five most numerous fish species comprised 54.79 per cent of the total count. In order, these fishes were Ctenochaetus strigosus (18.12%), Zebrasoma flavescens (11.47%), Thalassoma duperrey (11.12%), Acanthurus triostegus (8.38%) and Stegastes fasciolatus (5.33%).

Additionally, the standard length was estimated for 1,159 fish, or 58 per cent of the observed total. A separate distribution table has been plotted for the top 25 species in this list (Figs 18 - 42). The top five species of this study were Ctenochaetus strigosus (16.1%), Thalassoma duperrey (12.7%), Zebrasoma flavescens (11.8%), Acanthurus nigrofasciatus (7.7%) and Stegastes fasciolatus (7.3%).

## INTRODUCTION

On May 26, 1985, members of the University of Hawaii Marine Option Program (MOP) performed a random baseline survey of Ahihi - Kinau Natural Area Reserve, Maui for the Natural Area Reserves Commission of the State of Hawai'i Department of Land and Natural Resources.

This survey was the culmination of the 1985 Maui Transecting Workshop, an annual training session open to MOP students of all campuses (Maynard and Saint, 1985). The workshop was a 10-day intensive training program of lectures, seminars and survey techniques using SCUBA. The students prepared for the workshop for up to a year, taking safety courses and learning the names of marine flora and fauna, which they were tested on prior to the workshop.

## BACKGROUND

Ahihi Bay is located on the southern coast of Maui, near Makena (Fig. 1) and faces the island of Kaho'olawe. Ahihi Bay is one of two Natural Area Reserves within the State of Hawai'i. Primary users of Ahihi Bay are snorkelers and divers. Boating, fishing or collecting is not allowed inside Ahihi Bay. Natural Area Reserves are under the jurisdiction of the State of Hawai'i Department of Land and Natural Resources.

Figure 1 Map of Maui (Natl. Geo. 1981)

Scale 1:421,000

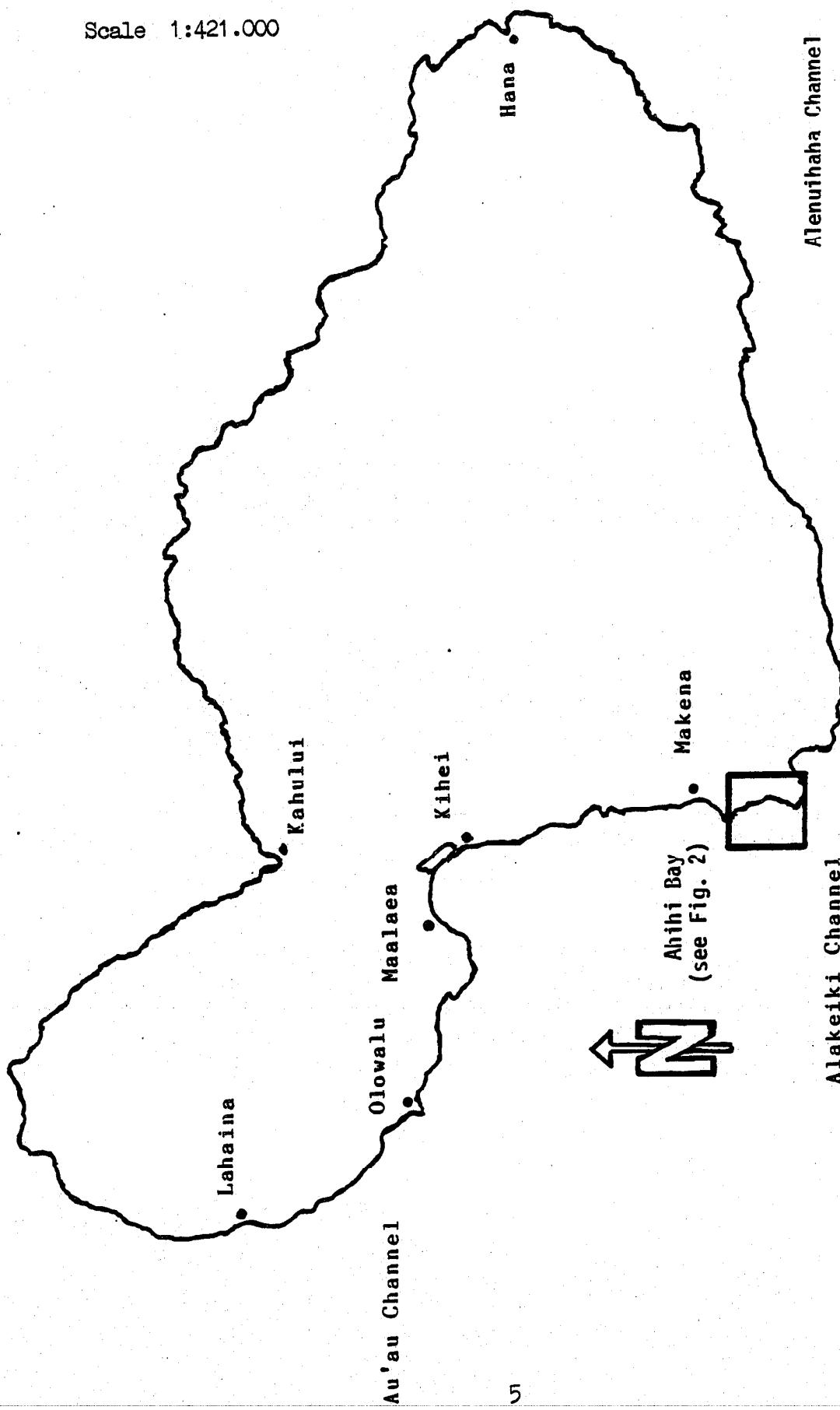
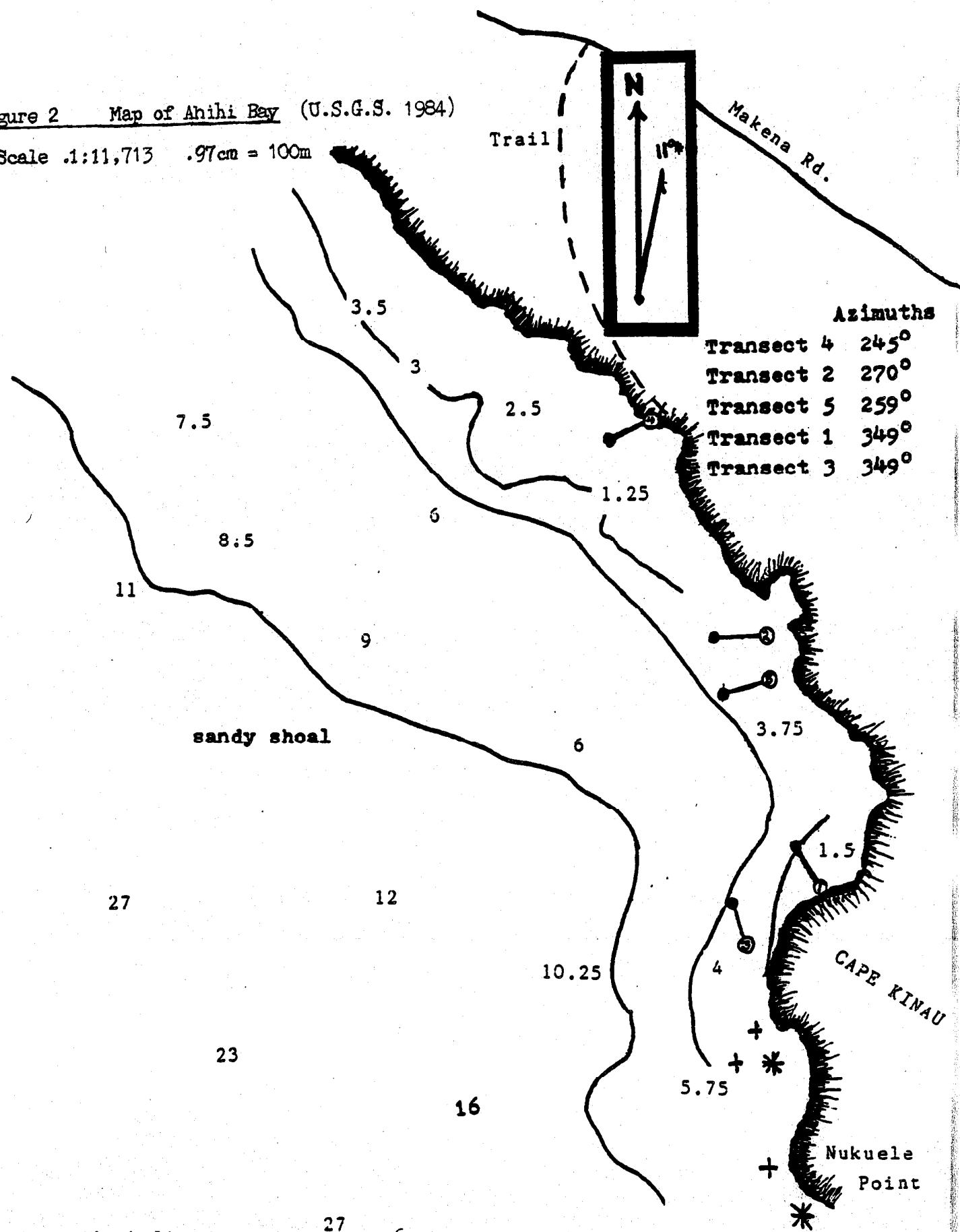


Figure 2 Map of Ahihi Bay (U.S.G.S. 1984)

Scale .1:11,713 .97cm = 100m



\*magnetic declination

soundings are in fathoms

PURPOSE

This survey served to gather representative baseline samplings of the fish population as well as depth, coral cover and substrate type within the Reserve.

The State of Hawaii Department of Land and Natural Resources need to conduct periodic surveys to determine the state of its reserves, and aid planning in their management. There is usually a constant demand for samples of such a large place as well; to have more data points and perhaps a clearer assessment of Ahihi - Kinau Natural Area Reserve.

## METHOD

### SETTING TRANSECT LINES

Five 100-meter transect lines were set and fastened to the bottom along headings perpendicular to the shoreline (see Fig. 2). Each line was marked at one-meter intervals.

### RECORDING DEPTHS OF TRANSECTS

At every meter, the depth and type of the substrate immediately below the transect line were recorded. The four categories were: limestone rubble, live coral, calcareous algae and sand. Depths were measured with wrist depth gauges.

### SAMPLING SUBSTRATE TYPE

The point quadrat method was used (Reed 1980). This utilizes a 1/2-meter square grid (Fig. 1). The frame of Polyvinyl chloride (PVC) tubing is strung with ten fishing line lengths set 10 centimeters apart. This forms 25 points where the lines cross. The grid is set every five meters along the transect line with the lower left corner under the meter marker. The type of substrate immediately below each point was recorded every five meters.

#### SAMPLING CORAL AND ALGAE ABUNDANCE

The grid quadrat method was implemented for this type of data (Reed 1980). The grid is one meter square and consists of a PVC tube frame and eight lengths of fishing line, which demarcate 16 units (Fig. 4). The percent and type of live coral and coralline algae within each unit is recorded. Again, the lower left corner of the grid is placed beneath every fifth meter marker.

#### SAMPLING FISH POPULATION

To count fish, each two-member survey unit used the Brock (1954) method of transecting. The observers swam in the same direction on either side of the transect line, and each counted every fish within five meters of the inside of the transect line, from the sea bottom up the water column to the surface. Fish that swam across the transect line into the observer's side were not counted by that observer to prevent over-estimating the abundance.

Some of the teams recorded the sizes of the fish as well. For this, the observers estimated the standard length of the fish in inches.

## RESULTS

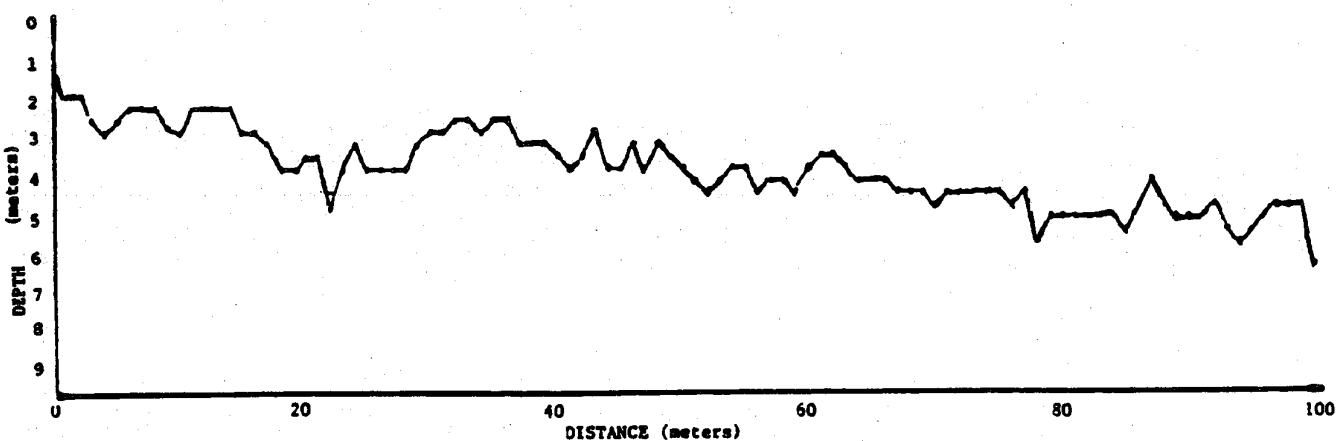
### DEPTH PROFILE

The maximum depth range of all five transects was zero to 8.54 meters (Figs. 3, 4, 5, 6). Transect Three was the deepest and furthest out to sea; the next deepest was Transect One, which finished in 6.1 meters of water (Fig. 2). Transects Two and Five were the shallowest, being entirely on the first reef from the central shore of the bay. Transect Four was close to the north point of the bay, and got to be 5.78 meters deep.

#### Transect One

This transect began 3.54 meters from shore in 1.22 meters of water, then sloped into a 4.58-meter deep groove in the reef between the 18 and 28 meter marks. The depth was 2.44 meters on the other side of the groove, but sloped erratically to 6.1 meters of water 103 meters offshore.

Figure 3 Depth Profile of Transect One



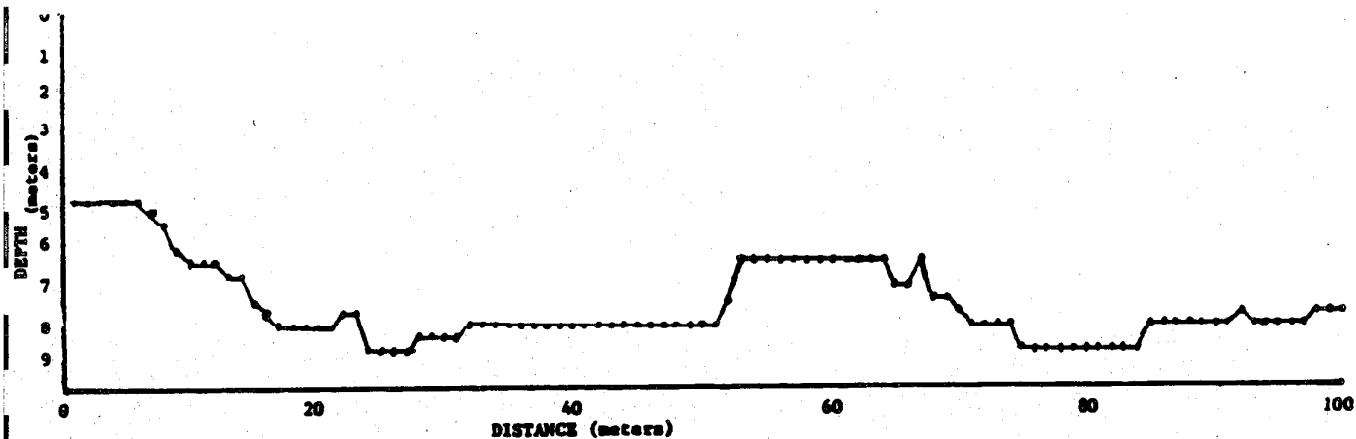
#### Transect Two

No depth was recorded here, but the area transected was close to and parallel to Transect Five.

### Transect Three

Transect Three began in 4.58 meters of water, then ran across two large grooves, both 8.54 meters deep. The spur of reef between the grooves was 5.49 meters deep. Beyond the second groove, the reef was in 7.62 meters of water.

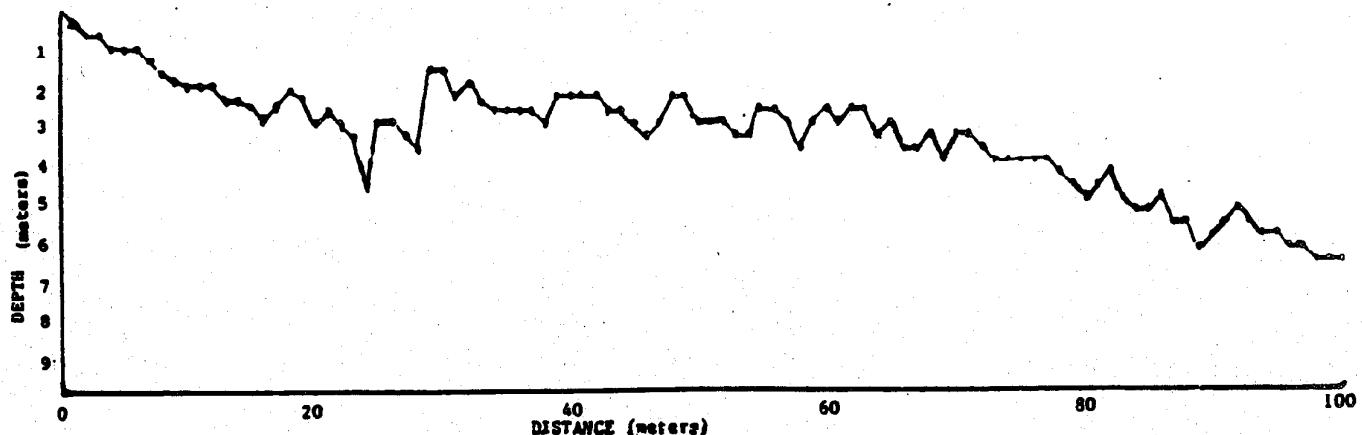
Figure 4 Depth Profile of Transect Three



### Transect Four

From the shoreline, Transect Four descended dramatically to a 4.58-meter deep depression and continued almost vertically to 1.53 meters deep. Gradually, though erratically, the depth increased to 5.8 meters, 100 meters from shore.

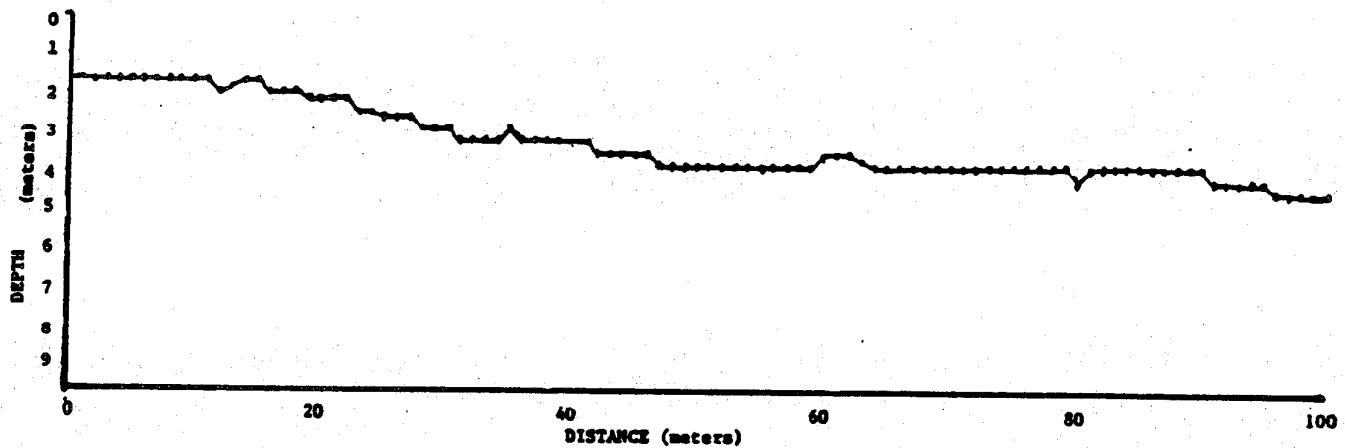
Figure 5 Depth Profile of Transect Four



### Transect Five

From 1.53 meters deep, this transect depth slowly increased to 3.66 meters at the 47 meter mark. A long plain followed all the way to the 91 meter mark. The gentle slope resumes and 100 meters from the shore the depth was 4.27 meters.

Figure 6      Depth Profile of Transect Five



### SUBSTRATE PROFILES

In Ahihi Bay, the basic substrate is limestone, which was seen on 51.64 per cent of the bottom (Figs. 6, 7, 8, 9, 10, Table 1). Sand rested in the grooves and holes, and accounted for 10 per cent of the cover. Corals and calcareous algae encrust parts of the limestone; together they covered 39.22 per cent of the bottom. The point quadrat method (Reed 1980) was used.

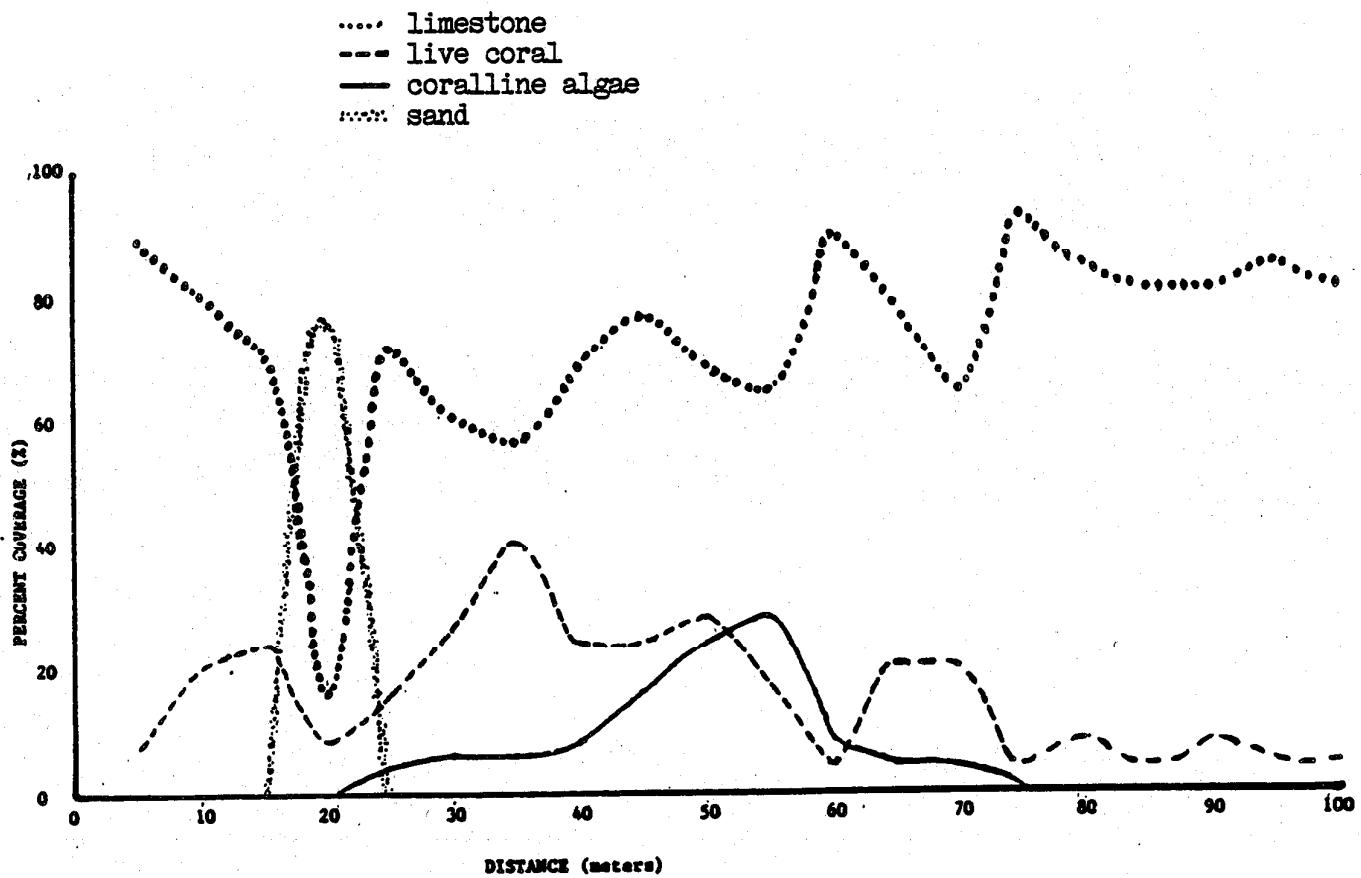
Table 1 Percentage of Substrate Cover in Ahihi Bay

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>Average</u>
limestone/rubble	78.7	37.3	28.8	44.2	68.8	51.64
coral	15.4	39.2	16.4	38.1	20	25.82
sand	3.6	3.6	29.6	10.8	1.8	9.88
algae	4.9	5.8	5.8	—	5.2	4.34

### Transect One

The coral populations as well as coralline algae were concentrated on the slopes of the groove and other depressions along the transect. Sand partially filled the large groove. However, limestone was the dominant substrate.

Figure 7 Substrate Profile of Transect One

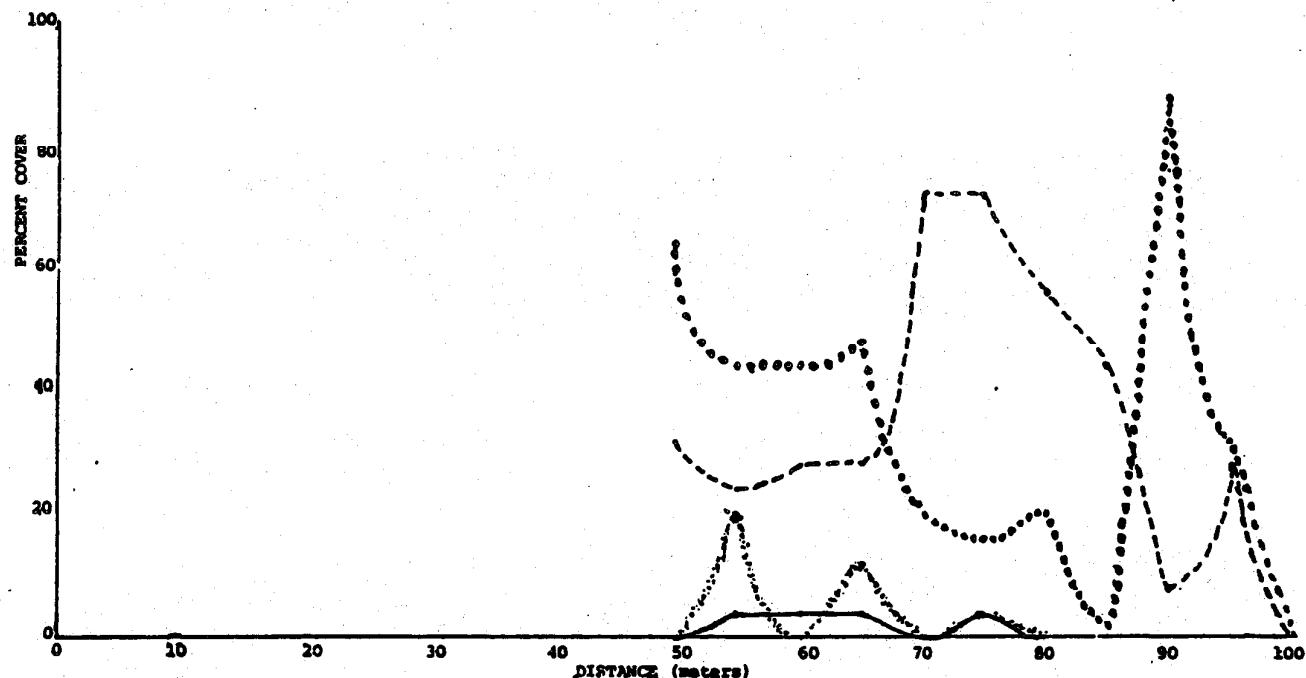


### Transect Two

Only the second half of this transect was profiled, and since the depth was not recorded, it is difficult to interpret what was recorded. This is the only profile where coral cover exceeded the visible limestone percentage. There was some calcareous algae and a little sand as well.

Figure 8 Substrate Profile of Transect Two

- .... limestone
- live coral
- coralline algae
- sand

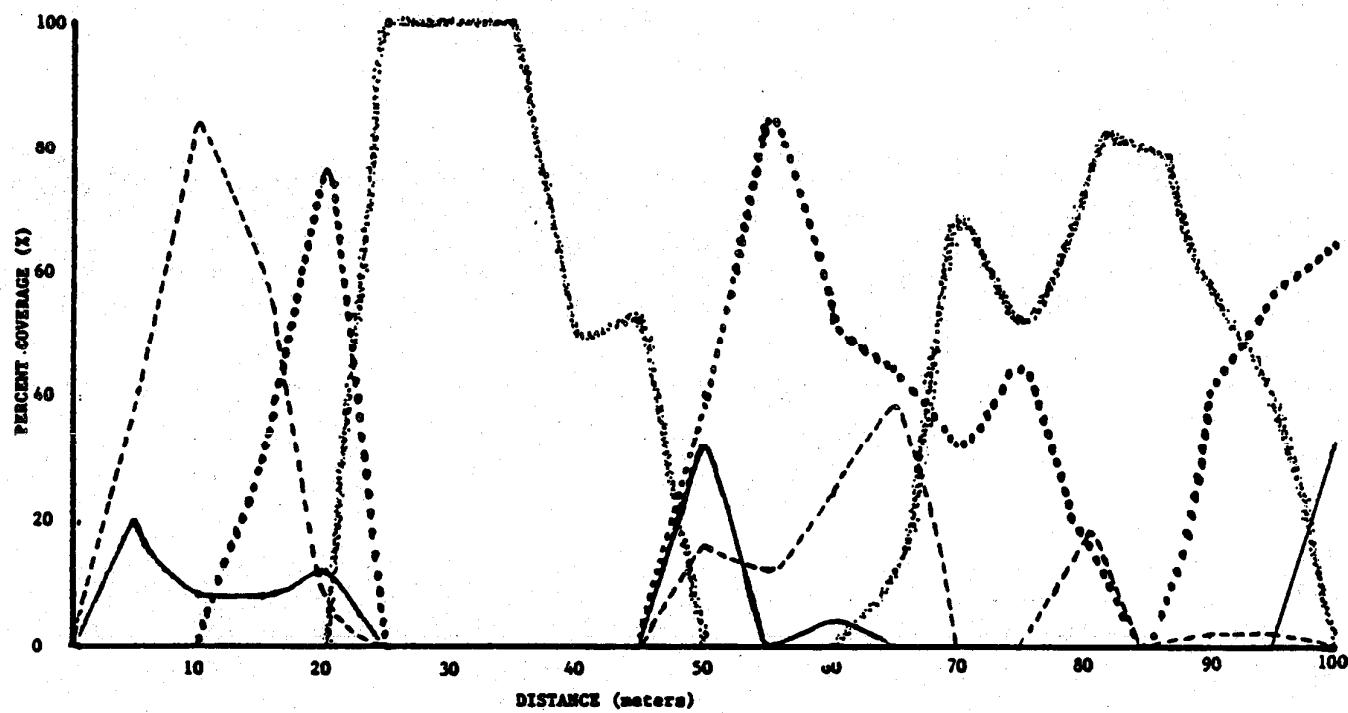


### Transect Three

Sand in the two large grooves exceeded both coral and limestone in terms of total coverage. The coral and calcareous algae were concentrated where the slopes of the grooves were where the coral and calcareous algae were concentrated. The flats of the reef were where limestone was most visible.

Figure 9 Substrate Profile of Transect Three

- ..... limestone rubble
- live coral
- coralline algae
- .... sand

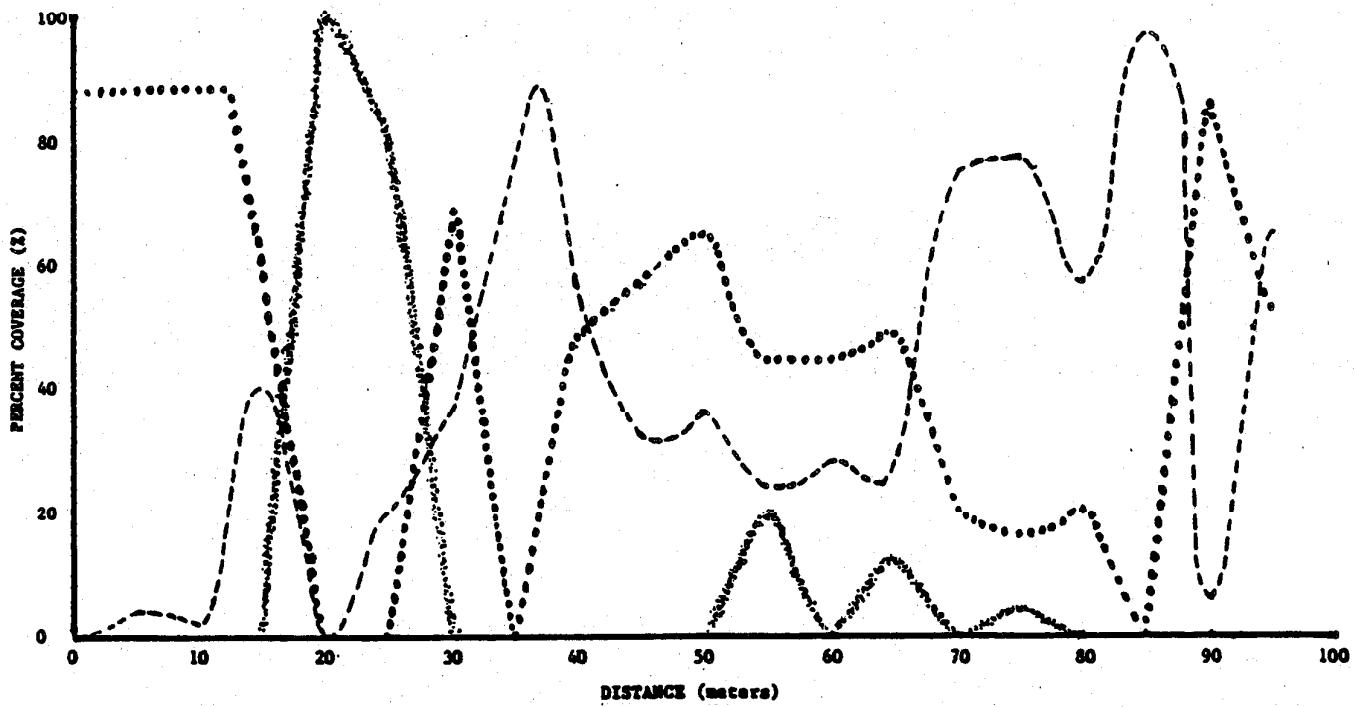


#### Transect Four

This transect had the second highest coral population. There was sand in the groove and other depressions, but most of the visible substrate was limestone rubble.

Figure 10 Substrate Profile of Transect Four

- ..... limestone rubble
- live coral
- ... sand



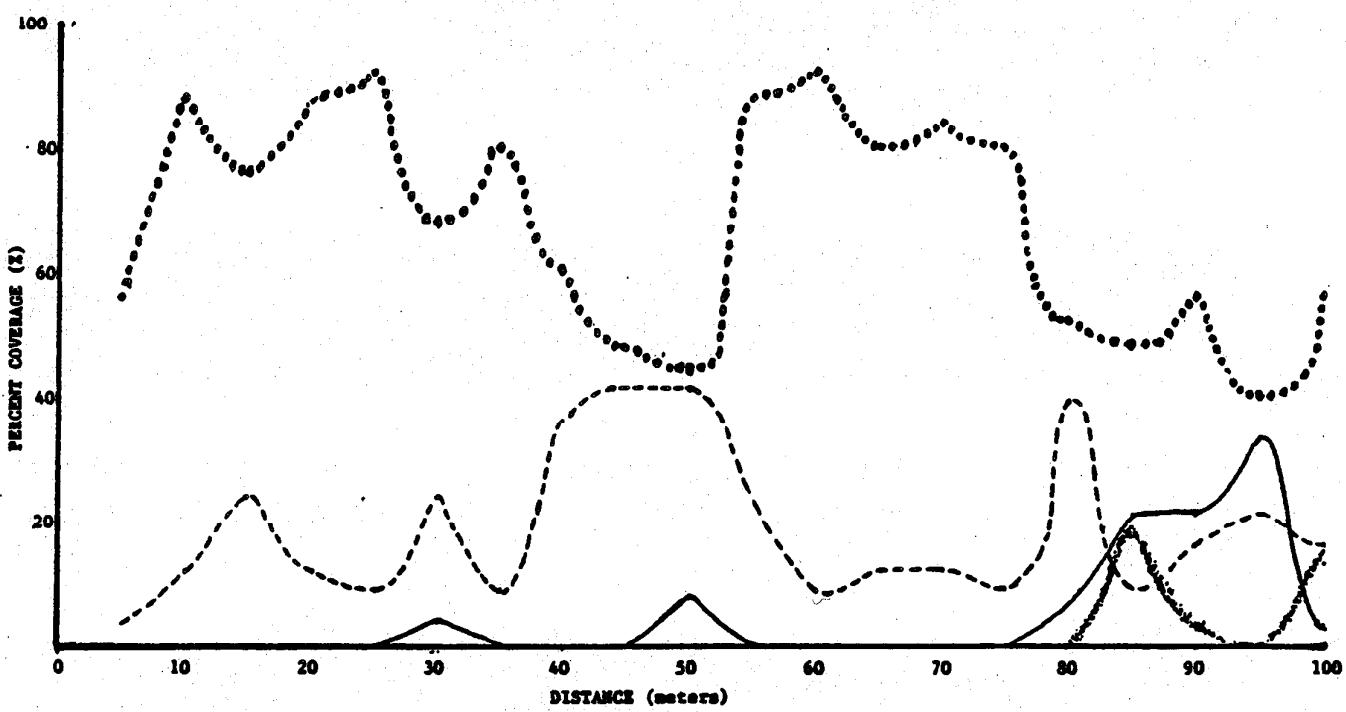
### Transect Five

There was a lot of uncolonized coral rubble in this transect (68.8%).

Calcareous algae was found on the flats, while coral was found on the flats and slopes. The last, flat plain had a little sand.

Figure 11 Substrate Profile of Transect Five

- live coral
- .... sand
- coralline algae
- ..... limestone rubble



### CORAL COVER

Overall coral cover was 16.4 per cent according to the grid quadrat method (Reed 1980) (Table 2). The two dominant species were Porites lobata and Pavona varians, which covered 5.9 and 5.12 per cent of the transects respectively (Figs. 12a- 13d). Pavona duerdeni (2.1%), Porites compressa (2%) and Pocillopora meandrina (0.89%) rounded out the top five of the 10 species found (Figs. 12a-15c). One colony of the zoanthid Palythoa tuberculosa was at the 10-meter mark seen on the second transect.

Table 2 TRANSECTS (in percentages)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>TOTAL</u>
<u>Porites lobata</u>	0.5	6.8	7.3	6	8.8	5.9
<u>Pavona varians</u>	17.7	2.1	0.6	1.6	3.6	5.12
<u>Pavona duerdeni</u>	1.9	7.1	—	—	1.6	2.1
<u>Porites compressa</u>	—	3.5	2.1	3.6	0.8	2
<u>Pocillopora meandrina</u>	0.1	—	—	4.2	—	0.89
<u>Montipora verrucosa</u>	0.2	1.6	—	1.6	—	0.64
<u>Leptastrea bottae</u>	0.1	—	—	—	0.8	0.18
<u>Porites convexa</u>	—	—	—	—	0.8	0.18
<u>Psammacora stellata</u>	0.01	—	—	—	—	0.02
<u>Pocillopora damicornis</u>	.06	—	—	—	—	.01
	20.57	21.1	10	17	12.8	16.4

### Transect One

Pavona varians dominated this transect by far. However this transect had the most diversity with eight species. 20.57 per cent coral cover was recorded; this is the second highest.

### Transect Two

Transect Two had the highest coral cover of 21.1 per cent. Pavona duerdeni (7.1 %) and Porites lobata (6.8%) were the most dominant of five species observed.

### Transect Three

Only 10 per cent coral cover was observed here; this was the lowest of all five transects. Also, only three species of coral were seen. This area appears to be a wave impact zone. There was also a lot of sand, which is a poor substrate for coral growth.

### Transect Four

Five species of coral existed here, covering 17.8 per cent of the area covered by Transect Four. The dominant species on this transect are Porites lobata (6%), Pocillopora meandrina (4.2%), and Porites compressa (3.6%).

### Transect Five

Six species were counted on this transect, however they only cover 12.8 per cent of the substrate. Porites lobata and Pavona varians were the top two, covering 8.8 and 3.6 per cents respectively.

1 Porites lobata

Combined coverage = 5.9%

Figure 12a Porites lobata distribution on Transect One

coverage = 0.5%

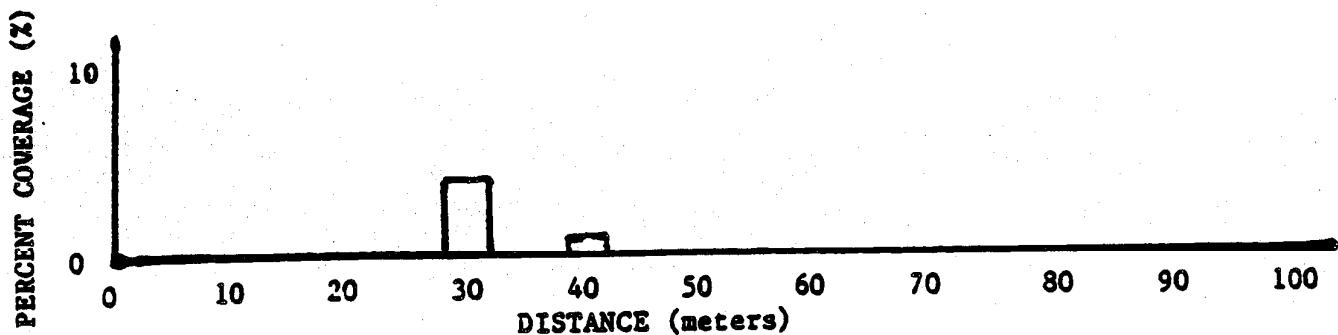


Figure 12b Porites lobata distribution on Transect Two

coverage = 6.8%

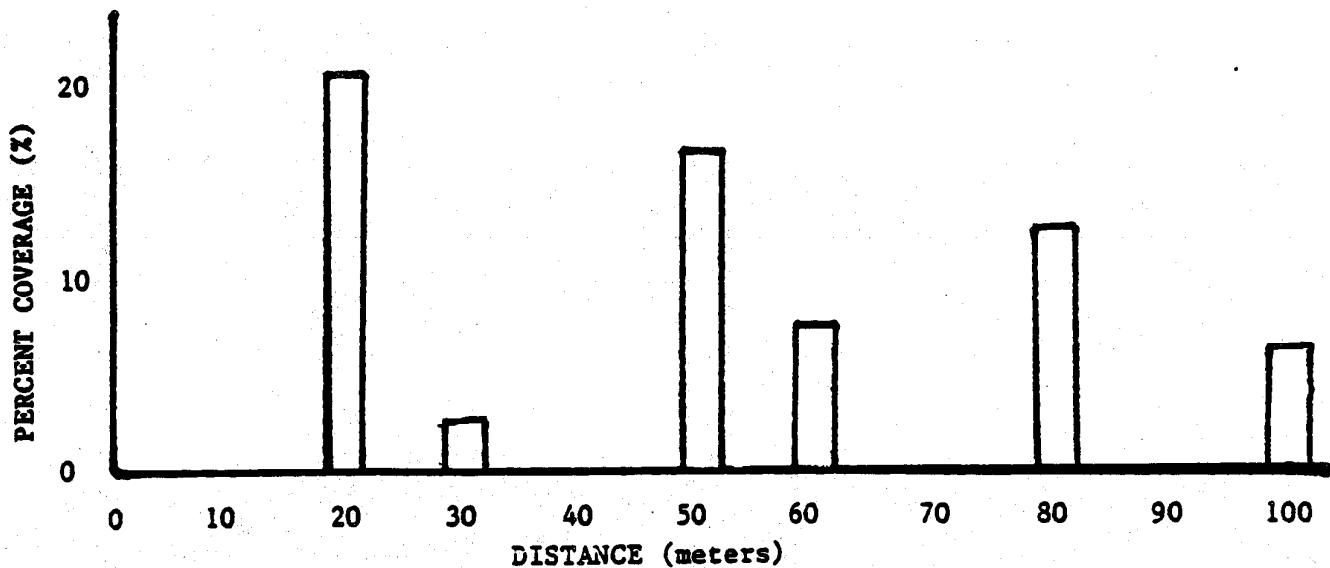


Figure 12c Porites lobata distribution on Transect Three

coverage = 7.3%

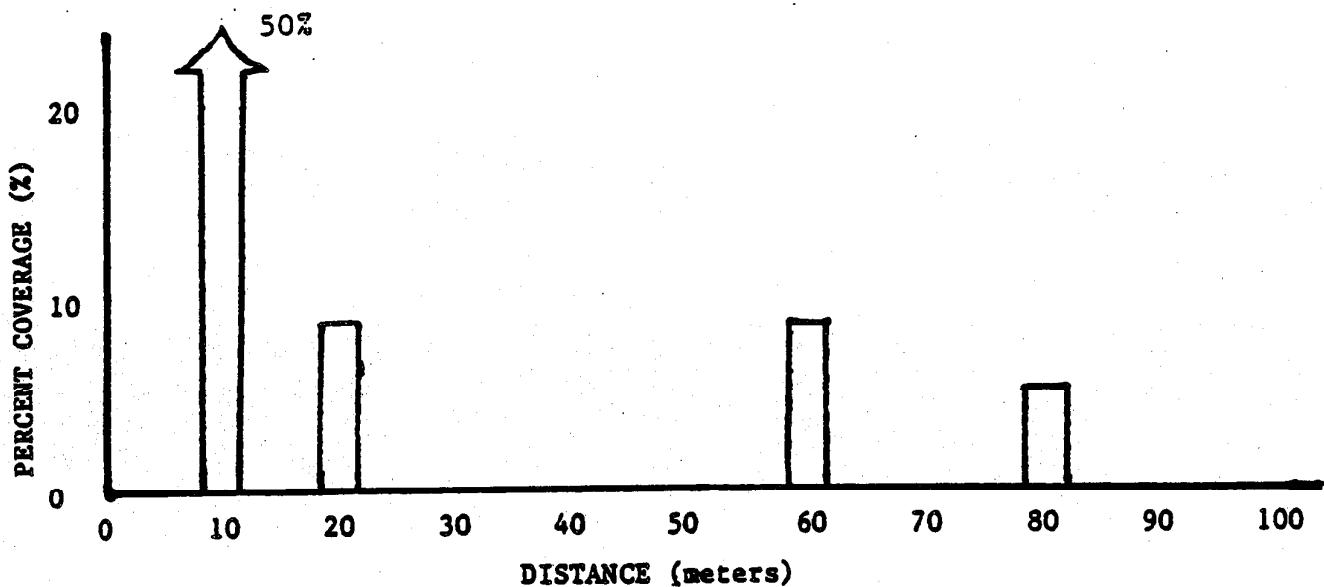


Figure 12d Porites lobata distribution on Transect Four

coverage = 6%

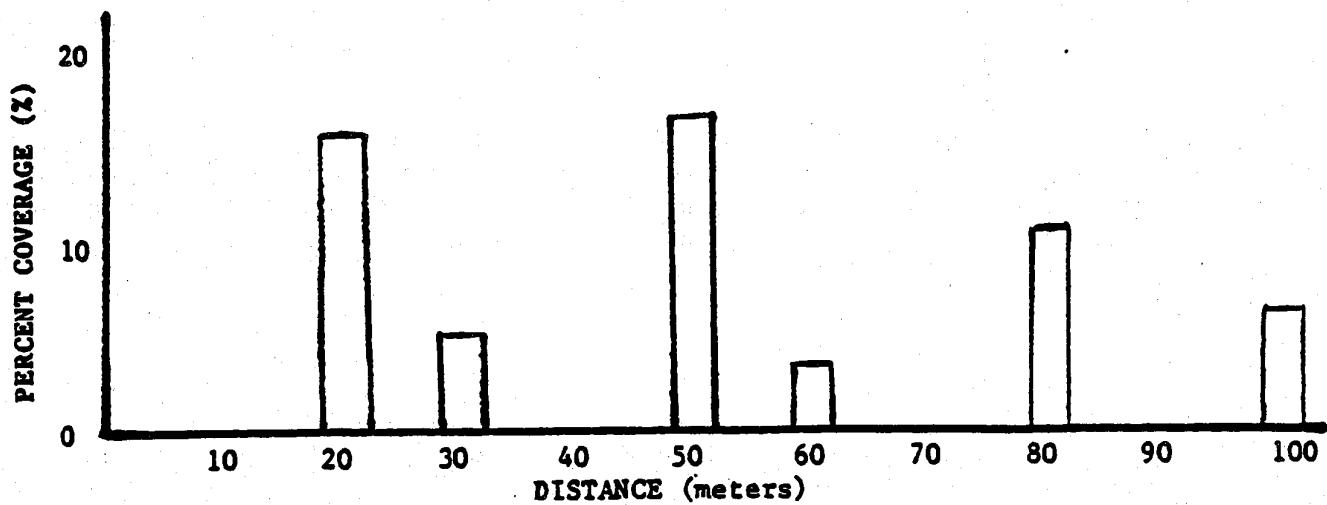
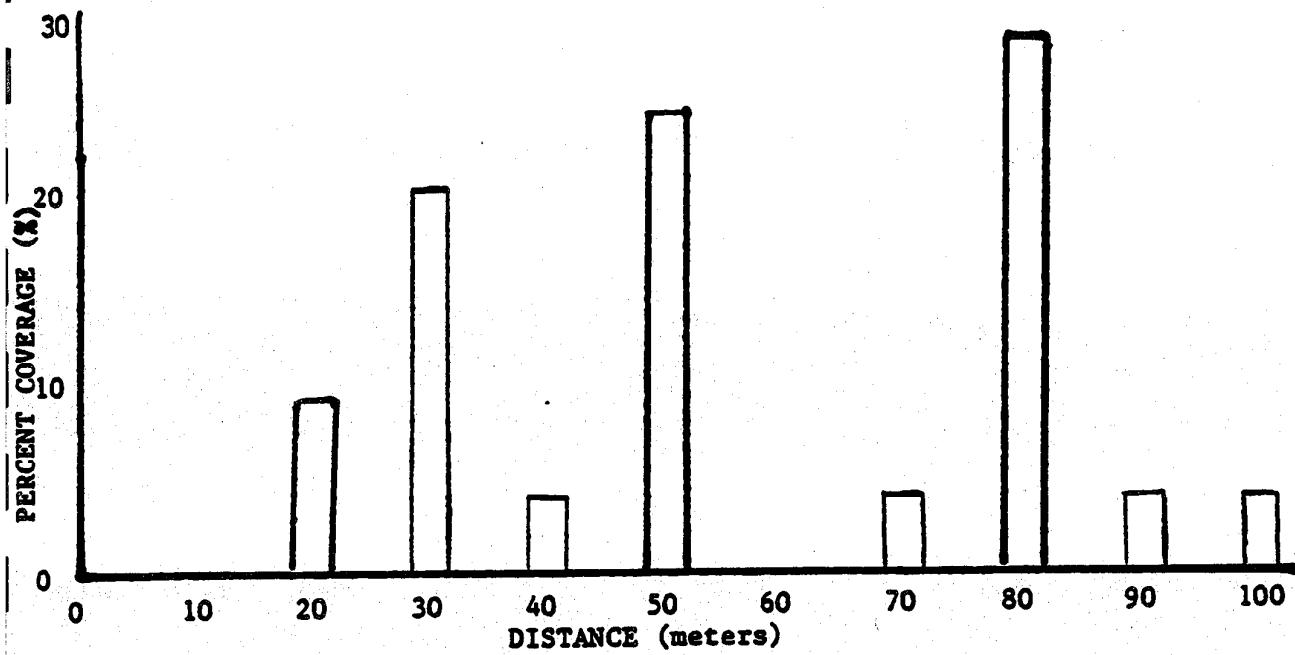


Figure 12e Porites lobata distribution on Transect Five  
coverage = 8.8%



2 Pavona varians

Combined coverage = 5.12%

Figure 13a Pavona varians distribution on Transect One

coverage = 17.7%

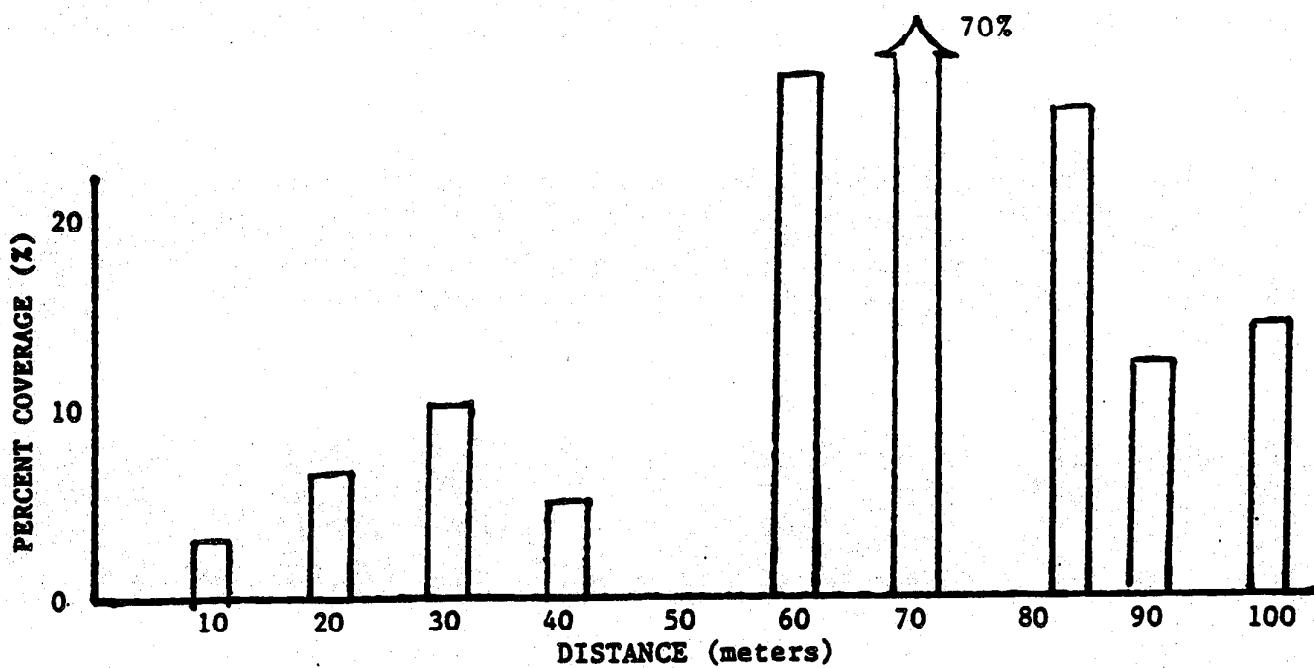
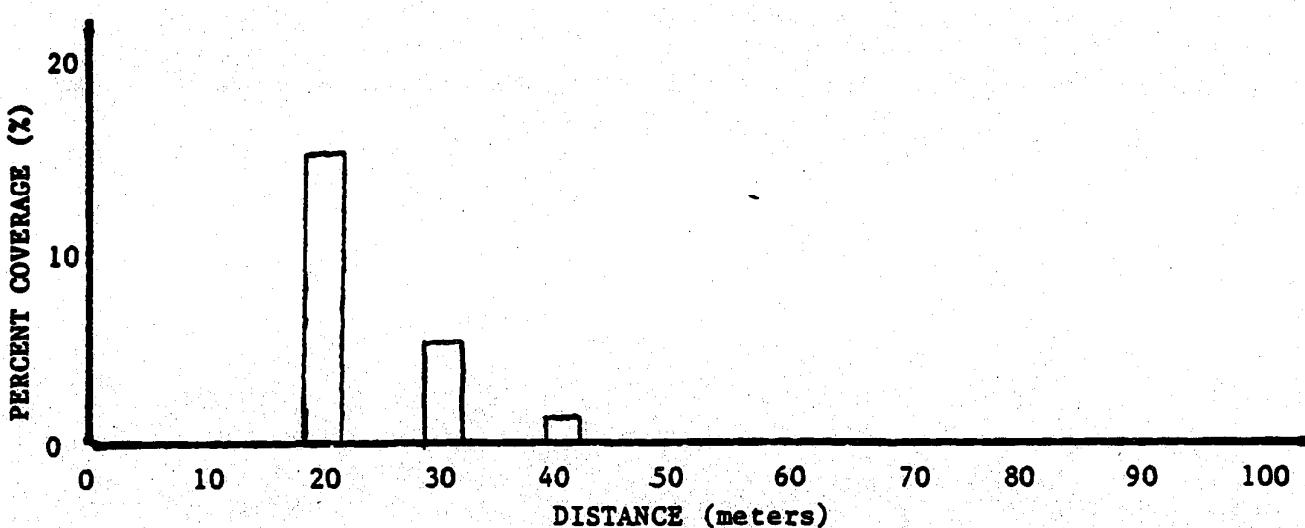


Figure 13b Pavona varians distribution on Transect Two

coverage = 2.1%



Transect Three, coverage = 0.6%

Figure 13c Pavona varians distribution on Transect Four

coverage = 1.6%

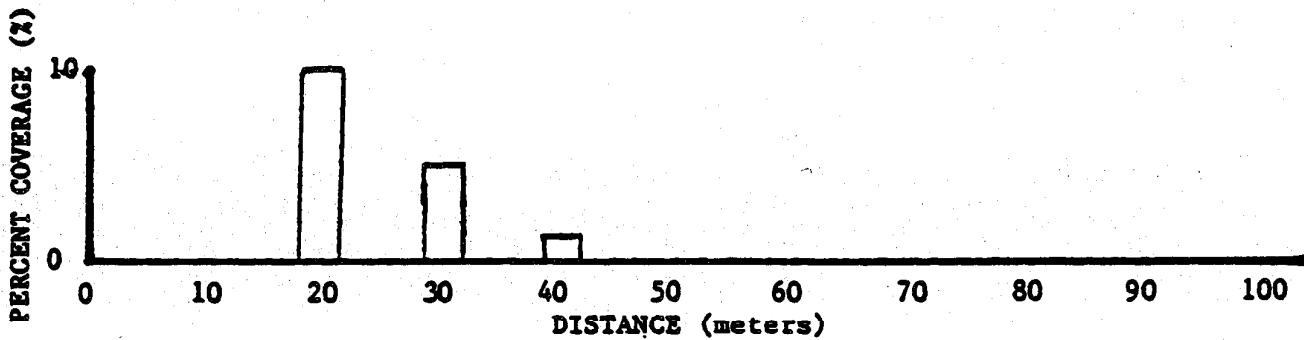
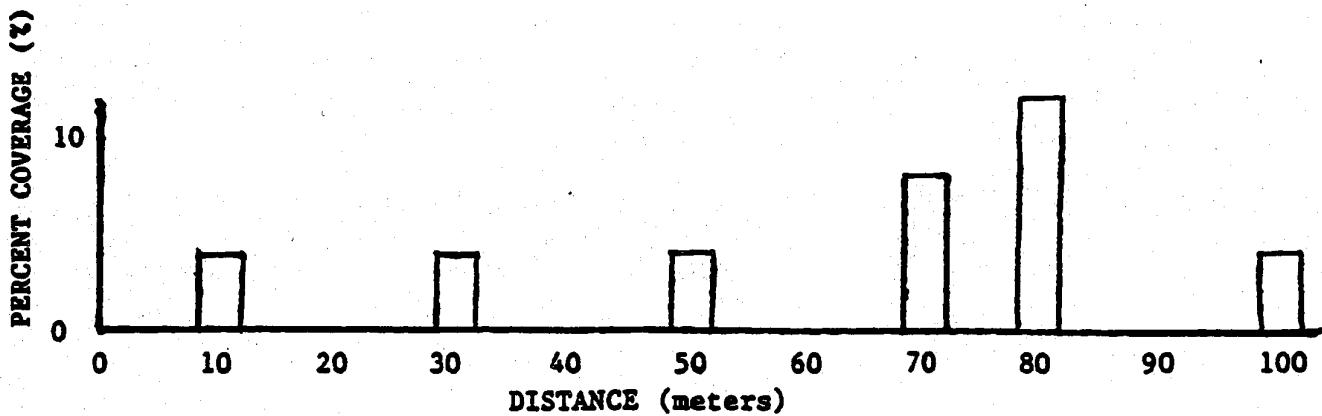


Figure 13d Pavona varians distribution on Transect Five

coverage = 3.6%



3 Pavona duerdeni

Combined coverage = 2.1%

Figure 14a Pavona duerdeni distribution on Transect One

coverage = 1.9%

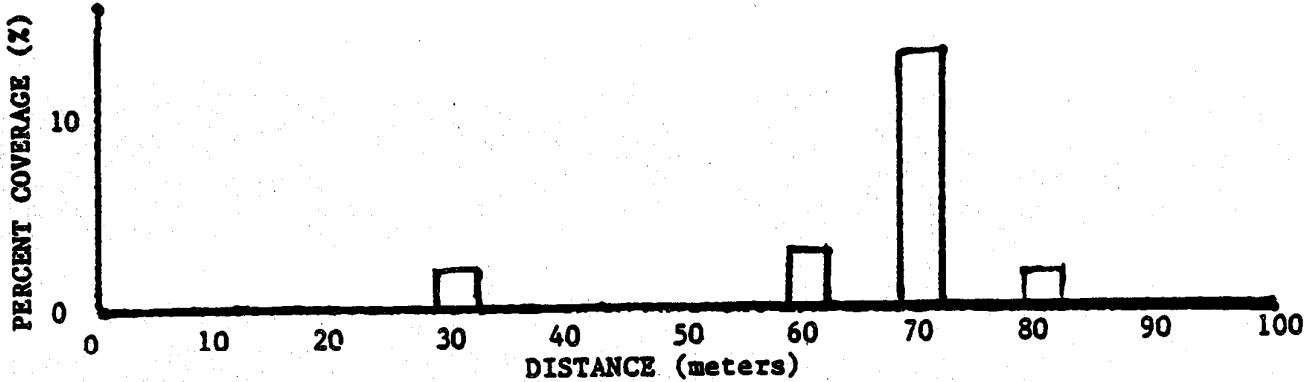


Figure 14b Pavona duerdeni distribution on Transect Two

coverage = 7.1%

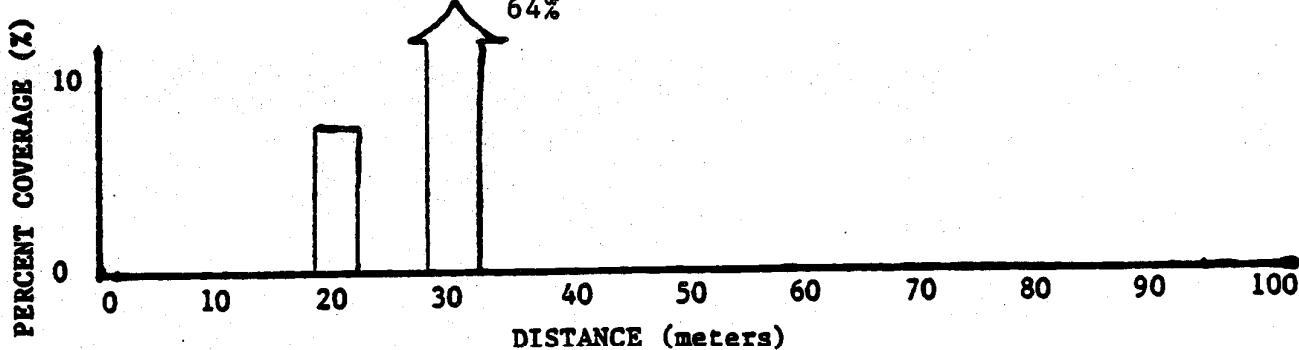
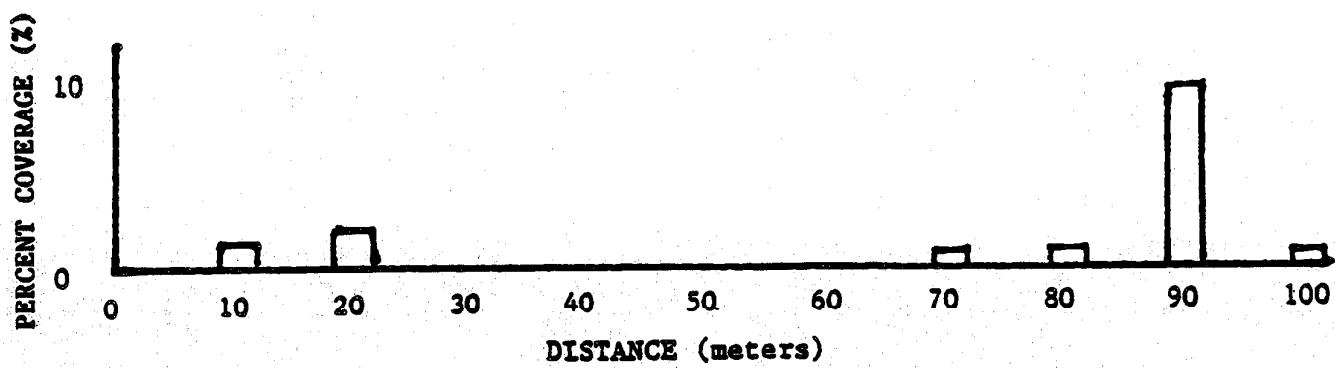


Figure 14c Pavona duerdeni distribution on Transect Five

coverage = 1.6%



4 Porites compressa

Combined coverage = 2%

Figure 15a Porites compressa distribution on Transect Two

coverage = 3.5%

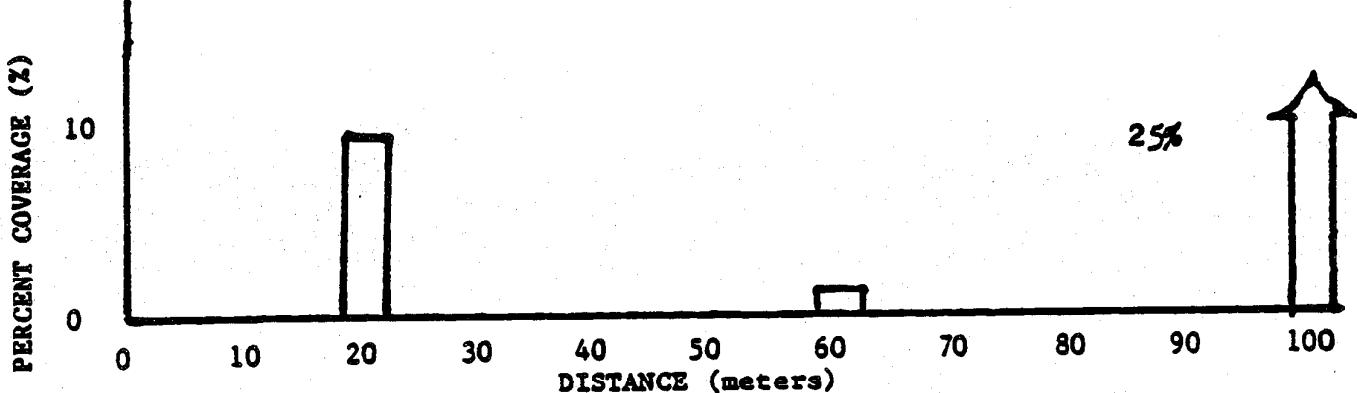


Figure 15b Porites compressa distribution on Transect Three

coverage = 2.1%

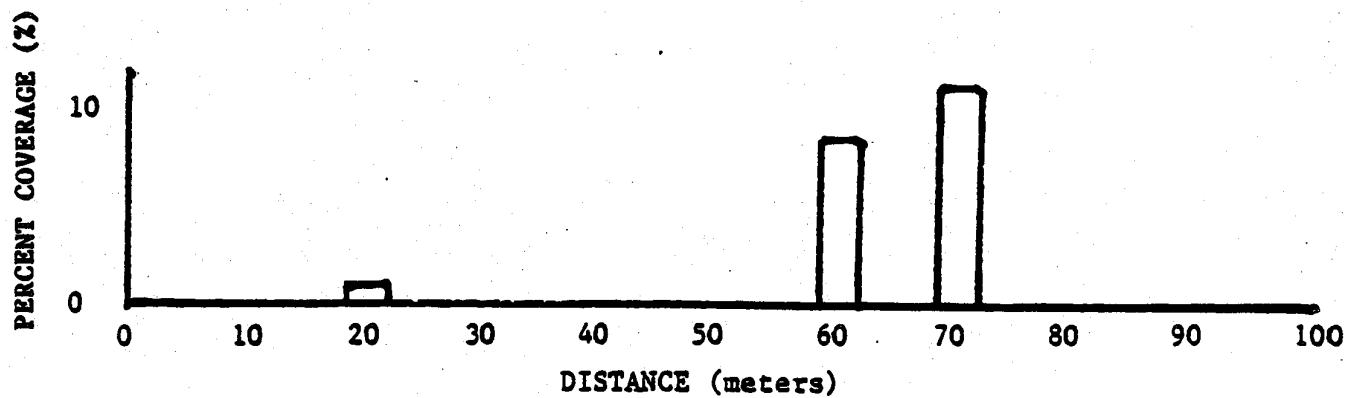
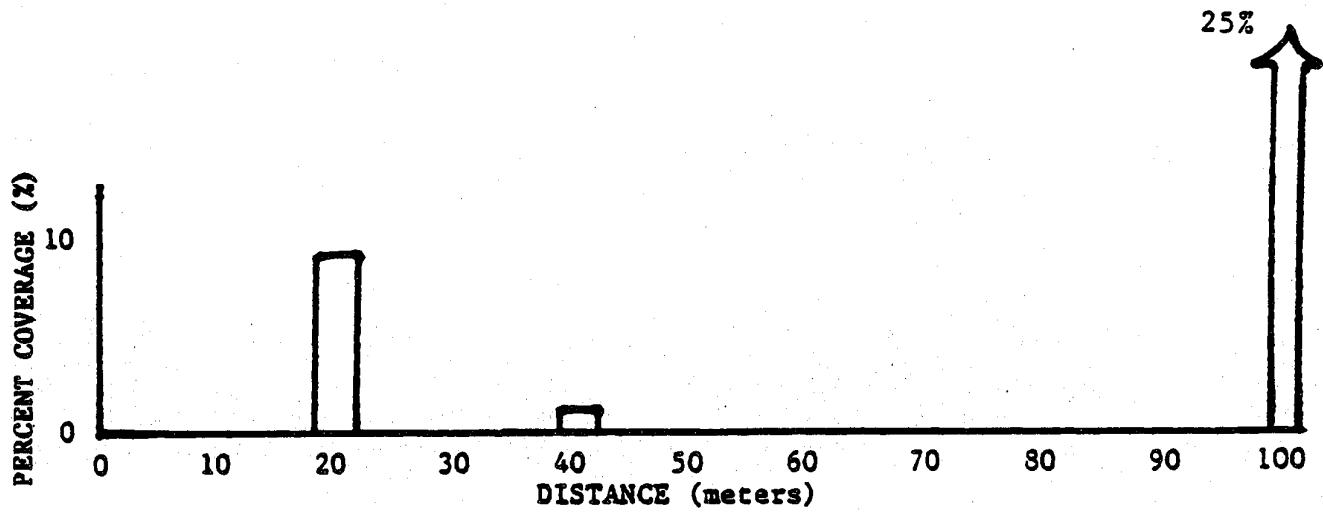


Figure 15c Porites compressa distribution on Transect Four

coverage = 3.6%



Transect Five; Porites compressa coverage = 0.8%

Table 3 Less abundant coral species

Species	Total Coverage	Transect	Coverage	Coverage/Location
5 <u>Pocillopora meandrina</u>	0.89%	1 5	0.1% 4.2%	0.6% at meter 50 28% at meter 40 16% at meter 50
6 <u>Montipora verrucosa</u>	0.64%	1 2 4	0.2% 1.6% 1.6%	1.9% at meter 80 15.6% at meter 40 15.6% at meter 40
7 <u>Leptastrea bottae</u>	0.16%	1 5	0.1% 0.8%	0.6% at meter 80 4% at meter 10 4% at meter 20
8 <u>Porites convexa</u>	0.16%	5	0.8%	8% at meter 80
9 <u>Psammacora stellata</u>	0.02%	1	0.1%	1% at meter 100
10 <u>Pocillopora damicornis</u>	0.01%	1	0.06%	0.6% at meter 70

### ZOANTHID

Besides coral, one other non-motile animal was seen. It was a colony of zooanthid Palythoa tuberculosa. It was only observed in one place on one of the transects.

1 Palythoa tuberculosa  
Combined coverage = 0.18%

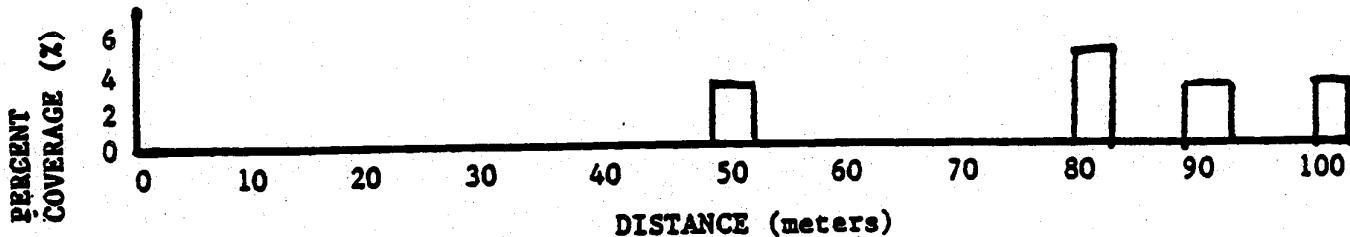
Transect Two, coverage = 0.9%  
observed 8.8% cover at meter 10

### CALCAREOUS ALGAE

The survey team found coralline algae to cover 14.4% per cent of the total area transected. Only two species were recorded. They were Porolithon gardineri and Porolithon onkodes (Figure 16, 17a, 17b).

1 Porolithon gardineri  
Combined coverage = 0.50% of total cover

Figure 16 Porolithon gardineri distribution on Transect One  
coverage = 1.4%



Transect Three, coverage = 0.13%  
observed 12.5% cover at meter 60

Transect Four, coverage = 0.06%  
observed 0.6% cover at meter 20

Transect Five, coverage = 0.4%  
observed 4% cover at meter 30

2 Porolithon onkodes

Combined coverage = 0.84% of total cover

Figure 17a Porolithon onkodes distribution on Transect Three

coverage = 0.1%

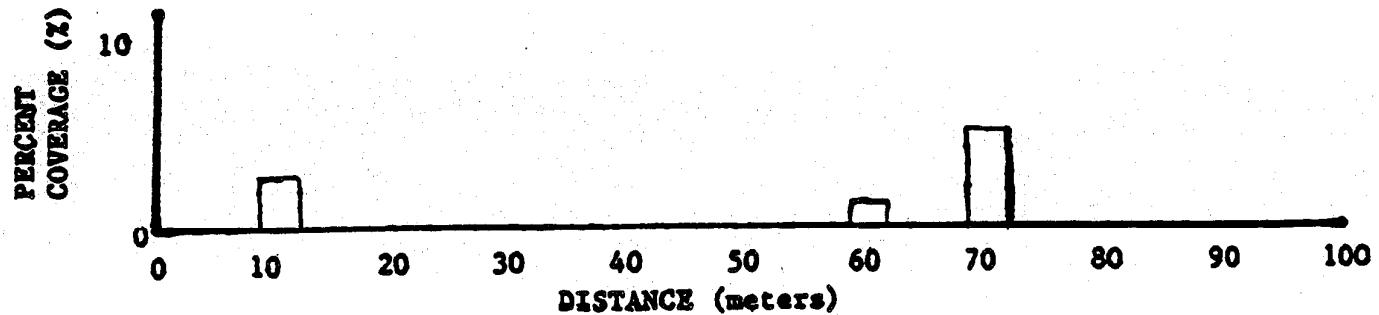
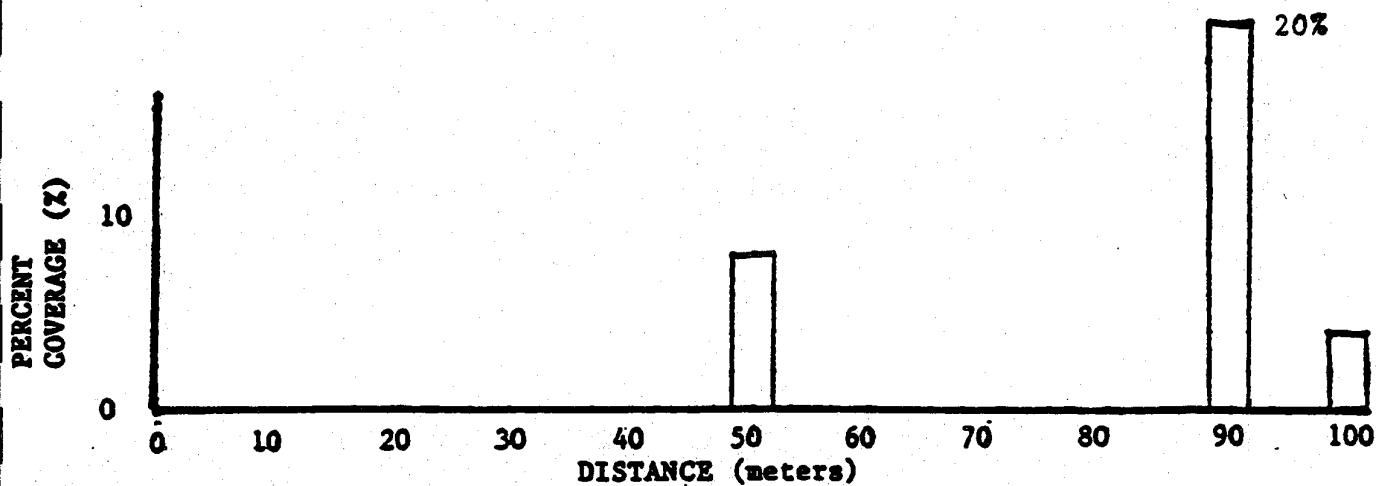


Figure 17b Porolithon onkodes distribution on Transect Five

coverage = 0.32%



### FISH TRANSECTS

A total of 10 transects were taken, two by each of the five teams. 1,970 fish were observed (Table 3). This is congruent to 1,594 fish per acre. The five most abundant species numbered 1,072 individuals, or 54.79 per cent of the count. They were, in order of population; Ctenochaetus strigosus, Zebrasoma flavescens, Thalassoma duperrey, Acanthurus triostegus and Stegastes fasciolatus. These five species made up 7.58 per cent of the total number (66) of species seen.

Table 4 Overall Number of Fish Observed in Ahii Bay

	Transects					All	Percent
	One	Two	Three	Four	Five		
1 <u>Ctenochaetus strigosus</u>	90	0	170	66	31	357	18.12%
2 <u>Zebrasoma flavescens</u>	33	50	40	64	39	226	11.47%
3 <u>Thalassoma duperrey</u>	35	30	42	74	38	319	11.12%
4 <u>Acanthurus triostegus</u>	19	100	36	10	0	165	8.38%
5 <u>Stegastes fasciolatus</u>	10	0	20	62	13	105	5.33%
6 <u>Mulloidess vanicolensis</u>	0	100	0	0	0	100	5.08%
7 <u>Acanthurus nigrofasciatus</u>	28	0	10	5	56	99	5.03%
8 <u>Melichthys niger</u>	12	40	0	5	8	65	3.30%
9 <u>Pervagor spilisoma</u>	6	5	15	16	5	47	2.39%
10 <u>Abudefduf abdominalis</u>	14	0	0	30	0	44	2.23%
11 <u>Acanthurus dussumieri</u>	30	0	0	0	6	36	1.83%
12 <u>Acanthurus nigroris</u>	10	5	10	5	0	30	1.52%
13 <u>Chaetodon multicinctus</u>	2	0	9	9	8	28	1.42%
14 <u>Naso litaratus</u>	17	3	3	0	5	28	1.42%
15 <u>Parupeneus multifasciatus</u>	17	0	5	2	3	27	1.37%
16 <u>Acanthurus achilles</u>	1	1	6	17	0	25	1.27%
17 <u>Chaetodon ornatissimus</u>	9	3	2	0	11	25	1.27%
18 <u>Stethojulis balteata</u>	0	0	5	20	0	25	1.27%
19 <u>Scarus spp.</u>	6	1	9	5	1	22	1.12%
20 <u>Acanthurus olivaceus</u>	12	6	3	0	0	21	1.07%
21 <u>Kyphosus bigibbus</u>	11	1	0	8	0	20	1.02%
22 <u>Gomphosus varians</u>	10	0	0	6	2	18	0.91%
23 <u>Acanthurus mata</u>	0	0	0	11	1	12	0.61%
24 <u>Kuhlia sandvicensis</u>	12	0	0	0	0	12	0.61%
25 <u>Chaetodon hanui</u>	3	7	0	0	2	12	0.61%
26 <u>Canthigaster jactator</u>	7	3	0	0	2	12	0.61%
27 <u>Coris venusta</u>	1	0	10	0	0	11	0.56%
28 <u>Naso spp.</u>	0	0	0	10	0	10	0.51%
29 <u>Mulloidess flavolineatus</u>	4	0	0	6	0	10	0.51%
30 <u>Acanthurus leucopareius</u>	5	0	3	0	1	9	0.46%
31 <u>Forcipinger spp.</u>	4	4	0	0	0	9	0.46%
32 <u>Chaetodon quadrimaculatus</u>	0	7	0	0	2	9	0.46%
33 <u>Parupeneus plurastigma</u>	8	0	0	0	0	8	0.41%
34 <u>Chaetodon unimaculatus</u>	2	0	0	6	0	8	0.41%
35 <u>Melichthys vidua</u>	8	0	0	0	0	8	0.41%
36 <u>Paracirrhites arcatus</u>	0	0	0	5	3	8	0.41%
37 <u>Aulostoma chinensis</u>	1	1	6	0	0	8	0.41%
38 <u>Centropyge potteri</u>	3	1	3	1	0	7	0.36%
39 <u>Chaetodon auriga</u>	7	0	0	0	0	7	0.36%
40 <u>Chaetodon frembliei</u>	0	1	6	0	0	7	0.36%
41 <u>Thalassoma ballieui</u>	0	3	0	4	1	6	0.31%
42 <u>Thalassoma purpureum</u>	3	0	0	2	1	6	0.31%
43 <u>Ostracion meleagris</u>	1	0	4	1	0	6	0.31%
44 <u>Zanclus cornutus</u>	2	1	3	0	0	6	0.31%
45 <u>Chromis vanderbilti</u>	0	5	0	0	1	6	0.31%
46 <u>Chaetodon miliaris</u>	1	0	4	0	0	5	0.26%
47 <u>Unknown</u>	0	5	0	0	0	5	0.26%
48 <u>Abudefduf sindonis</u>	0	0	0	4	0	4	0.21%

Table 4 (cont.) Overall Number of Fish Observed in Ahihi Bay

	Transects					All	Percent
	One	Two	Three	Four	Five		
49 <u>Scarus dubius</u>	0	0	0	1	2	3	0.15%
50 <u>Scarus perspicillatus</u>	0	0	0	3	0	3	0.15%
51 <u>Rhinecanthes rectangulus</u>	3	0	0	0	0	3	0.15%
52 <u>Labroides spp.</u>	1	0	0	1	0	2	0.10%
53 <u>Abudefduf sordidus</u>	2	0	0	0	0	2	0.10%
53 <u>Coris gaimard</u>	0	0	0	1	1	2	0.10%
54 <u>Canthigaster amboiensis</u>	0	0	0	2	0	2	0.10%
55 <u>Parupeneus spp.</u>	0	2	0	0	0	2	0.10%
56 <u>Parupeneus bifasciatus</u>	0	0	0	0	1	1	0.05%
57 <u>Diodon histrix</u>	0	0	0	1	0	1	0.05%
58 <u>Gymnomuraena zebra</u>	1	0	0	0	0	1	0.05%
59 <u>Pomacanthidae</u>	0	1	0	0	0	1	0.05%
60 <u>Balistidae</u>	0	1	0	0	0	1	0.05%
61 <u>Sargocentron spp.</u>	0	1	0	0	0	1	0.05%
TOTAL	451	388	424	464	243	1970	100.00%
PERCENT	22.89	19.69	21.52	23.55	12.34	100.00%	

Transect One

The following were the five most frequently noted species out of the two fish transects. The five most abundant species comprised 47.89 per cent of the 451 fishes. 41 species were recorded.

Table 4 Five most abundant fish species on Transect One

Species	Number	Per Cent
<u>Ctenochaetus strigosus</u>	90	19.95%
<u>Thalassoma duperrey</u>	35	7.76%
<u>Zebrasoma flavescens</u>	33	7.32%
<u>Acanthurus dussumieri</u>	30	6.65%
<u>Acanthurus nigrofascus</u>	28	6.21%
	<u>216</u>	<u>47.89%</u>

Transect Two

Out of the two fish transects conducted, the 320 fish in the big five category totalled 82.47 per cent of the total of 388 fish observed. 33 species were recorded.

Table 5 Five most abundant fish species on Transect Two

Species	Number	Per Cent
<u>Acanthurus nigrofascus</u>	100	25.77%
<u>Acanthurus triostegus</u>	100	25.77%
<u>Zebrasoma flavescens</u>	50	12.89%
<u>Melichthys niger</u>	40	10.31%
<u>Thalassoma duperrey</u>	30	7.73%
	<u>320</u>	<u>82.47%</u>

### Transect Three

Of the two fish transects conducted, the five most abundant types of fish equalled 76.24 per cent of the 24 species; and 72.64 per cent of the 424 observed number of individuals.

Table 6 Five most abundant fish species on Transect Three

Species	Number	Per Cent
<u>Ctenochaetus strigosis</u>	170	40.09%
<u>Thallasoma duperrey</u>	42	9.91%
<u>Zebrasoma flavescens</u>	40	9.43%
<u>Acanthurus triostegus</u>	36	8.49%
<u>Stegastes fasciolatus</u>	20	4.72%
	<u>308</u>	<u>72.64%</u>

### Transect Four

The five most observed species were 14.71 per cent of the 34 species and 57.9 per cent of the 464 fish sighted. Two fish transects were performed.

Table 7 Five most abundant fish species on Transect Four

Species	Number	Per Cent
<u>Thalassoma duperrey</u>	74	15.95%
<u>Ctenochaetus strigosus</u>	66	14.22%
<u>Zebrasoma flavescens</u>	64	13.79%
<u>Stegastes fasciolatus</u>	62	13.36%
<u>Abudefduf abdominalis</u>	30	6.47%
	<u>296</u>	<u>57.90%</u>

Transect Five

From two transects, 243 fish were counted, 25 species were observed. The five most abundant species was 72.84 per cent of the total count or 177 out of 243 fish seen.

Table 8 Five most abundant fish species on Transect Five

Species	Number	Per Cent
<u>Acanthurus nigrofasciatus</u>	56	23.05%
<u>Zebrasoma flavescens</u>	39	16.05%
<u>Thalassoma duperrey</u>	38	15.64%
<u>Ctenochaetus strigosis</u>	31	12.76%
<u>Stegastes fasciolatus</u>	13	5.35%
	177	72.84%

### FISH SIZES

Three transect teams recorded the standard lengths of the 55 species of fish that they observed. The populations of Transects One, Four and Five are listed below (Table 9). Then, the 25 most abundant species have been graphed by their per cent of the total population as well as size (Figs. 18a-42c). Each of these species has a graph that denotes its percentage according to size in proportion to the total fish observed. Also included are the transect graphs of the fish sizes according to the percentage reported by the separate transect teams. Statistics of the 20 less-frequent species follow.

Distributions skewed to the right (larger fish) may indicate predation of the juveniles or lack of new recruitment of that species. A normal distribution might represent a balanced population. The majority of these fish are mature, but still growing. Heavy recruitment or predation of mature fish will result in a distribution skewed to the left.

Table 9 Fish Observed and Sized in Ahihi Bay

	Transects				
	One	Four	Five	All	Percent
1 <u>Ctenochaetus strigosus</u>	90	66	31	187	16.1%
2 <u>Thalassoma duperrey</u>	35	74	38	147	12.0%
3 <u>Zebrasoma flavescens</u>	33	64	39	136	11.8%
4 <u>Acanthurus nigrofasciatus</u>	28	5	56	89	7.7%
5 <u>Stegastes fasciolatus</u>	10	62	13	85	7.3%
6 <u>Abudefduf abdominalis</u>	14	30	0	44	3.8%
7 <u>Acanthurus dussumieri</u>	30	0	6	36	3.1%
8 <u>Acanthurus trigostegus</u>	19	10	0	29	2.5%
9 <u>Pervagor spilosoma</u>	6	16	5	27	2.3%
10 <u>Melichthys niger</u>	12	5	8	25	2.2%
11 <u>Parupeneus multifasciatus</u>	17	2	3	22	1.9%
12 <u>Naso literatus</u>	17	0	5	22	1.9%
13 <u>Stethojulis balteata</u>	0	20	0	20	1.7%
14 <u>Chaetodon ornatissimus</u>	9	0	11	20	1.7%
15 <u>Chaetodon multicinctus</u>	2	9	8	19	1.6%
16 <u>Kyphosus bigibbus</u>	11	8	0	19	1.6%
17 <u>Acanthurus achilles</u>	1	17	0	18	1.6%
18 <u>Gomphosus varius</u>	10	6	2	18	1.6%
19 <u>Acanthurus nigroris</u>	10	5	0	15	1.3%
20 <u>Scarus spp.</u>	6	5	1	12	1.0%
21 <u>Acanthurus mata</u>	0	11	1	12	1.0%
22 <u>Acanthurus olivaceus</u>	12	0	0	12	1.0%
23 <u>Kuhlia sandvicensis</u>	12	0	0	12	1.0%
24 <u>Naso spp.</u>	0	10	0	10	0.9%
25 <u>Mulloidess flavolineatus</u>	4	6	0	10	0.9%
26 <u>Canthigaster jactator</u>	7	0	2	9	0.7%
27 <u>Parupeneus plurastigma</u>	8	0	0	8	0.7%
28 <u>Chaetodon unimaculatus</u>	2	6	0	8	0.7%
29 <u>Melichthys vidua</u>	8	0	0	8	0.7%
30 <u>Paracirrhites arcatus</u>	0	5	3	8	0.7%
31 <u>Chaetodon auriga</u>	7	0	0	7	0.6%
32 <u>Acanthurus leucoperius</u>	5	0	1	6	0.5%
33 <u>Thalassoma purpurium</u>	3	2	1	6	0.5%
34 <u>Chaetodon hanui</u>	3	0	2	5	0.4%
35 <u>Forcipiger spp.</u>	4	1	0	5	0.4%
36 <u>Abudefduf sindonis</u>	0	4	0	4	0.3%
37 <u>Centropyge potteri</u>	3	1	0	4	0.3%
38 <u>Thalassoma ballieui</u>	0	4	0	4	0.3%
39 <u>Ostracion meleagris</u>	1	1	1	3	0.3%
40 <u>Scarus dubius</u>	0	1	2	3	0.3%
41 <u>Scarus perspicillatus</u>	0	3	0	3	0.3%
42 <u>Rhinecanthes rectangulus</u>	3	0	0	3	0.3%
43 <u>Zanclus cornutus</u>	2	0	0	2	0.2%
44 <u>Labroides species</u>	1	1	0	2	0.2%

Table 9 (cont.) Fish Observed and Sized in Ahihi Bay

	Transects				
	One	Four	Five	All	Percent
45 <u>Coris gaimard</u>	0	1	1	2	0.2%
46 <u>Chaetodon quadrimaculatus</u>	0	0	2	2	0.2%
47 <u>Canthigaster amboiensis</u>	0	2	0	2	0.2%
48 <u>Abudefduf sordidus</u>	2	0	0	2	0.2%
49 <u>Coris venusta</u>	1	0	0	1	0.1%
50 <u>Aulostoma chinensis</u>	1	0	0	1	0.1%
51 <u>Chaetodon milliaris</u>	1	0	0	1	0.1%
52 <u>Parupeneus bifasciatus</u>	0	0	1	1	0.1%
53 <u>Chromis vanderbilti</u>	0	0	1	1	0.1%
54 <u>Diodon histrix</u>	0	0	1	1	0.1%
55 <u>Gymnomuraena zebra</u>	1	0	0	1	0.1%
TOTAL	451	464	244	1159	100.00%
PERCENT	38.91	40.04	21.05	100.00	

1 Ctenochaetus strigosus

Figure 18a Combined count of Ctenochaetus strigosus sizes

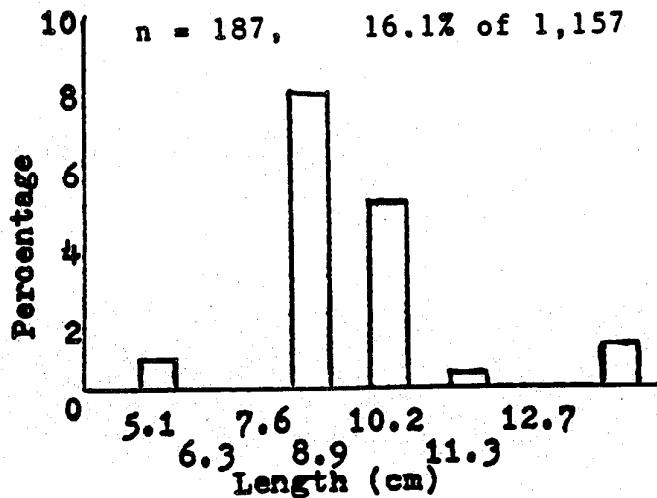


Figure 18b  
Ctenochaetus strigosus sizes  
of Transect One

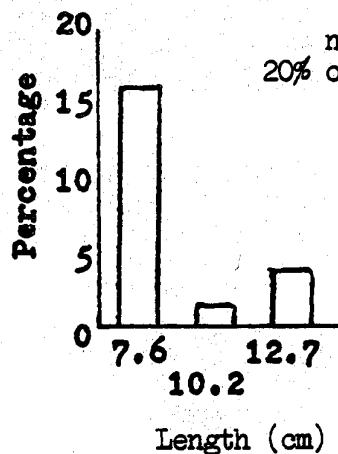


Figure 18c  
Ctenochaetus strigosus sizes of Transect Four

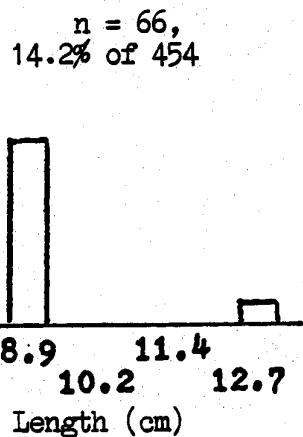
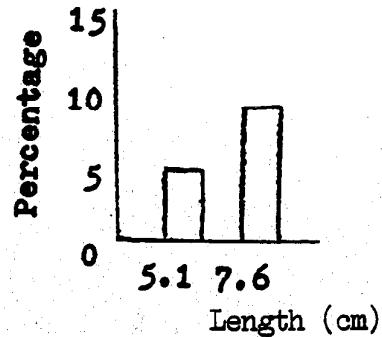


Figure 18d  
Ctenochaetus strigosus sizes  
of Transect Five  
n = 31, 12.7% of 244



2 *Thalassoma duperrey*

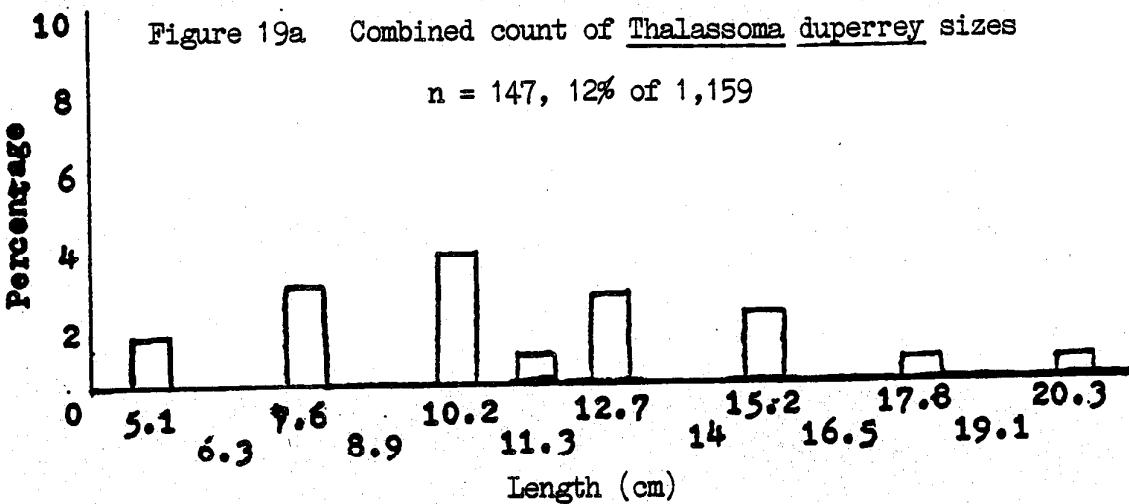


Figure 19b  
*Thalassoma duperrey* sizes  
of Transect One

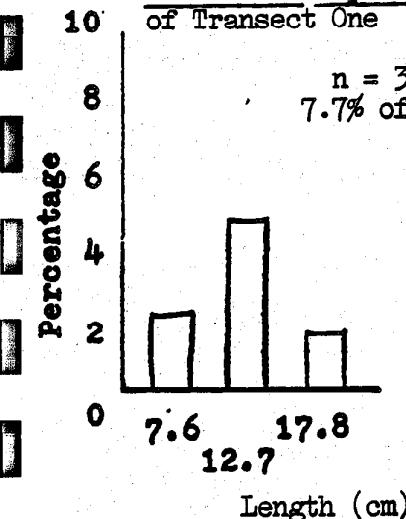


Figure 19c  
*Thalassoma duperrey* sizes  
of Transect Four

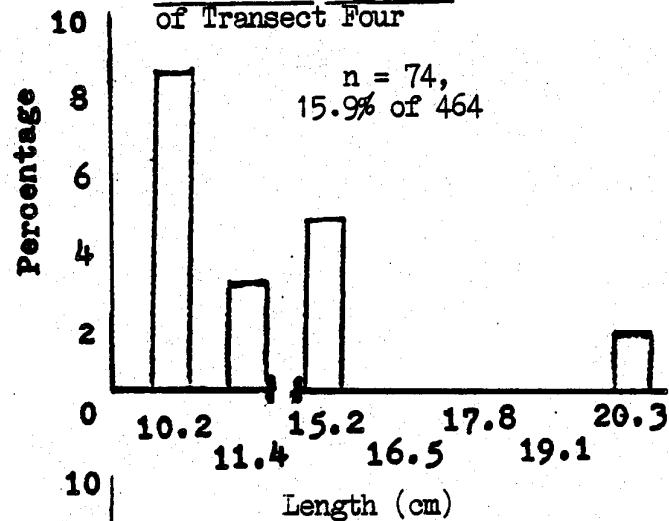
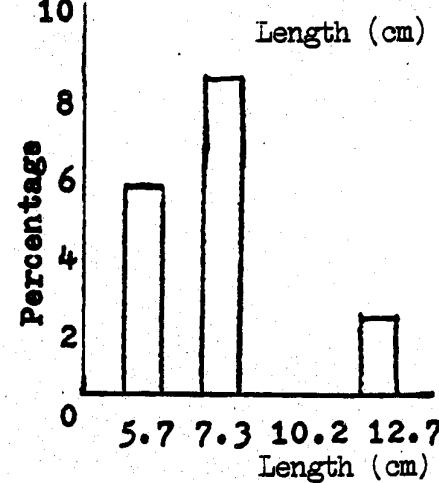


Figure 19d *Thalassoma duperrey*  
sizes of Transect Five

$n = 38$ ,  
15.6% of 244



### 3 *Zebrasoma flavescens*

Figure 20a Combined count of *Zebrasoma flavescens* sizes

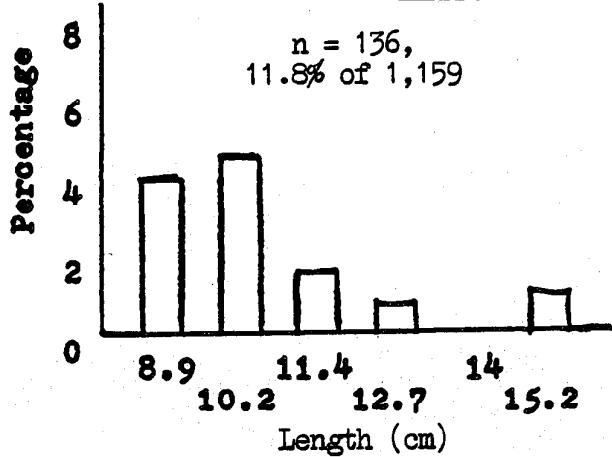


Figure 20b  
*Zebrasoma flavescens* sizes  
of Transect One

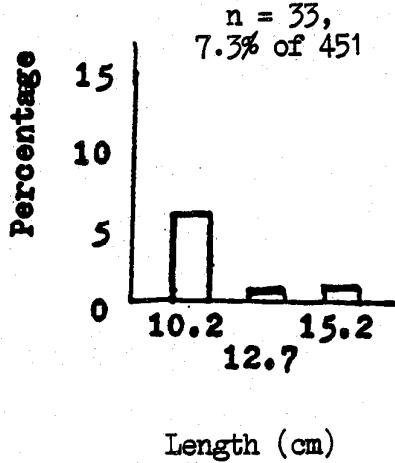


Figure 20c  
*Zebrasoma flavescens* sizes  
of Transect Four

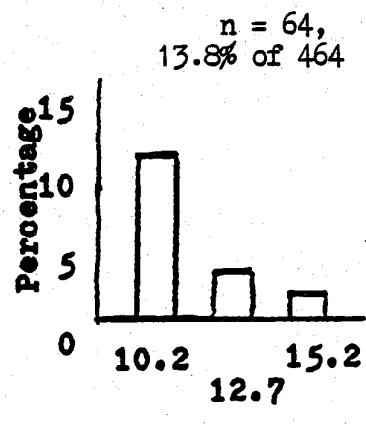
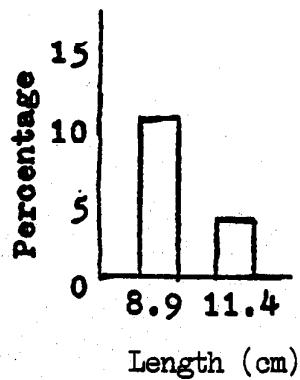


Figure 20d *Zebrasoma flavescens*  
sizes of Transect Five

n = 39,  
16% of 244



4 Acanthurus nigrofascus

Figure 21a Combined count of Acanthurus nigrofascus sizes

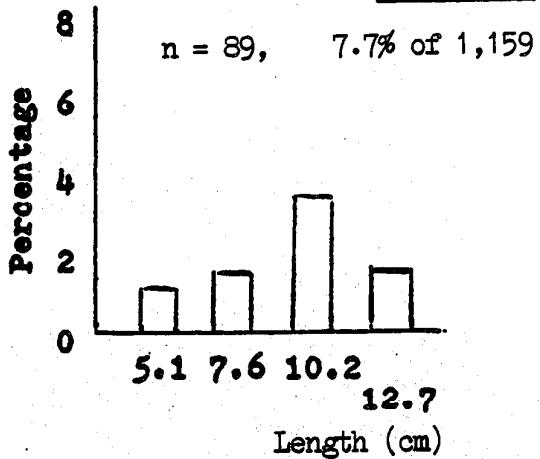


Figure 21b  
Acanthurus nigrofascus  
sizes of Transect One

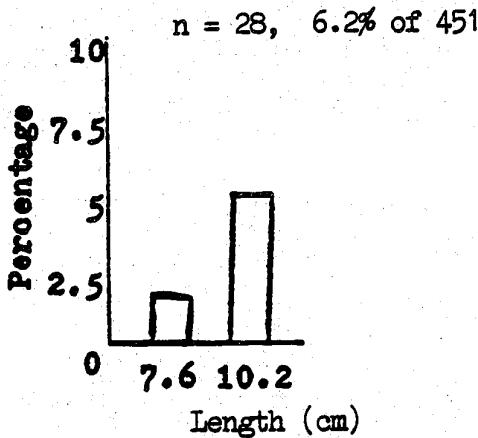


Figure 21c  
Acanthurus nigrofascus  
sizes of Transect Four

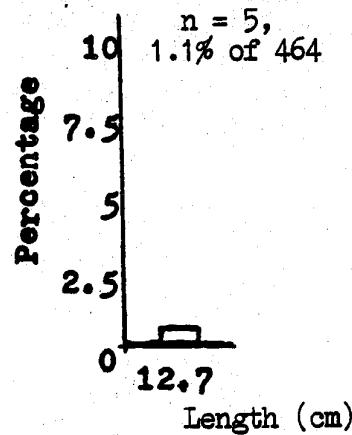
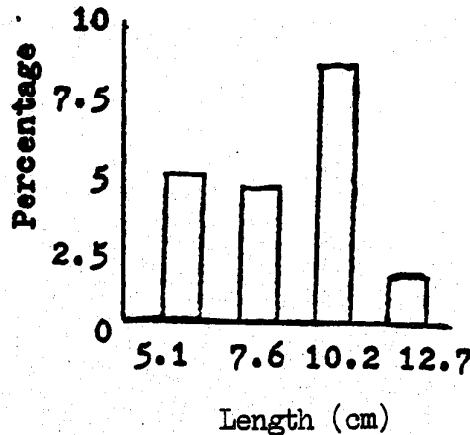


Figure 21d Acanthurus nigrofascus  
sizes of Transect Five

n = 56, 22.9% of 244



5 *Stegastes fasciolatus*

Figure 22a Combined count of *Stegastes fasciolatus* sizes

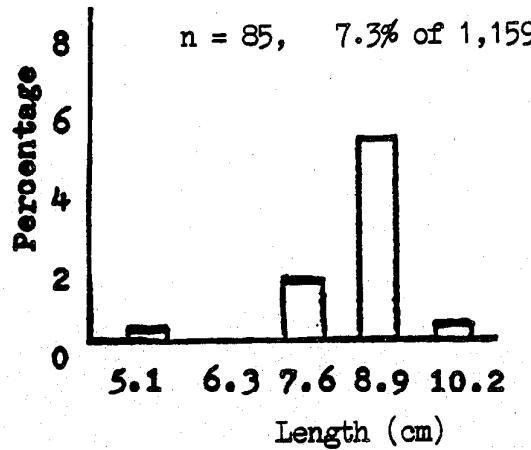


Figure 22b  
*Stegastes fasciolatus* sizes  
of Transect One

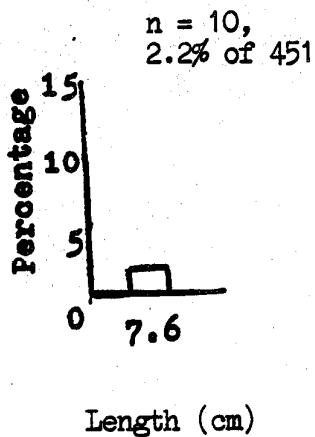


Figure 22c  
*Stegastes fasciolatus* sizes  
of Transect Four

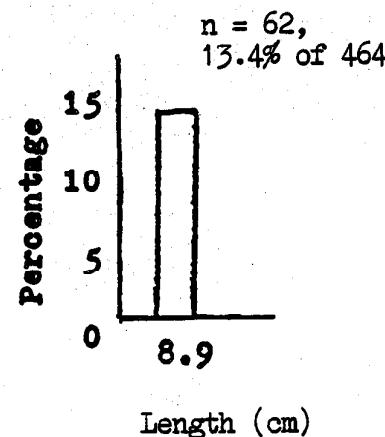
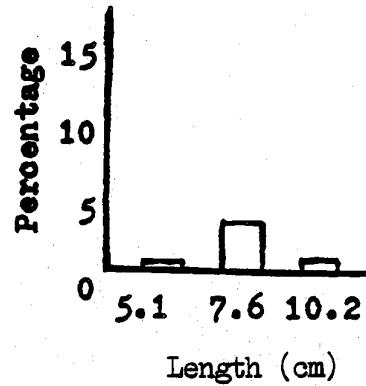


Figure 22d *Stegastes fasciolatus*  
sizes along Transect Five

n = 13, 5.3% of 244



## 6 Abudefduf abdominales

Figure 23a Combined count of  
Abudefduf abdominales sizes

n = 44, 3.8% of 1,159

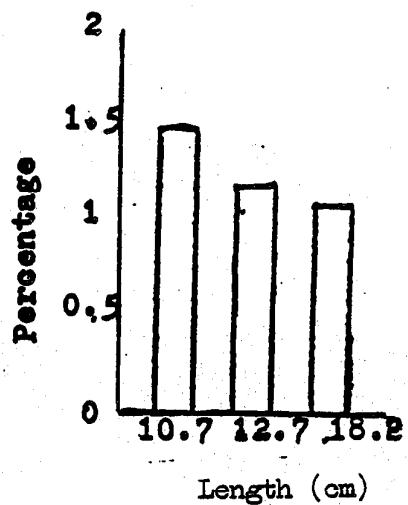


Figure 23b Abudefduf abdominales  
sizes of Transect One

n = 14, 3.1% of 451

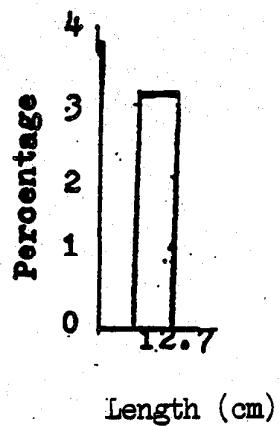
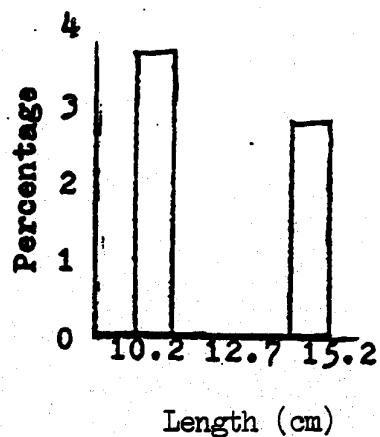


Figure 23c Abudefduf abdominales  
sizes of Transect Four

n = 30, 6.5% of 464



7 Acanthurus dussumieri

Figure 24a Combined count of  
Acanthurus dussumieri sizes

n = 36, 3.1% of 1,159

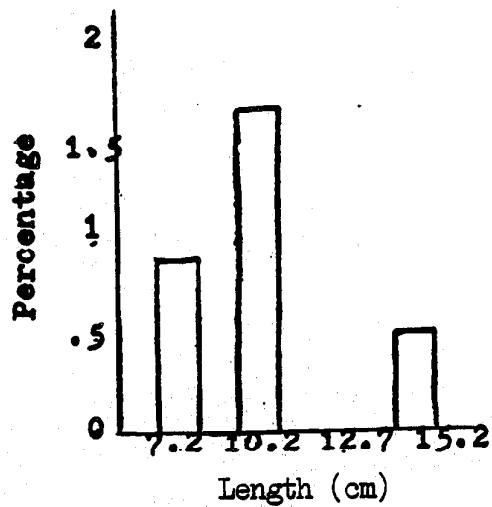


Figure 24b Acanthurus dussumieri  
sizes of Transect One

n = 30, 6.7% of 451

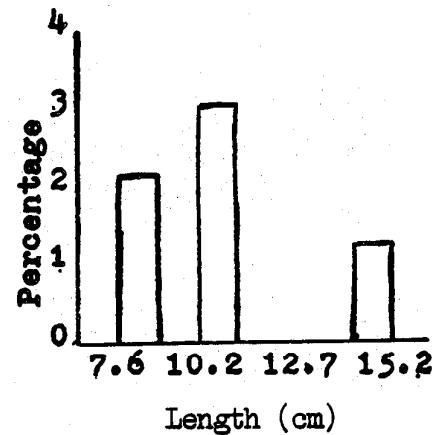
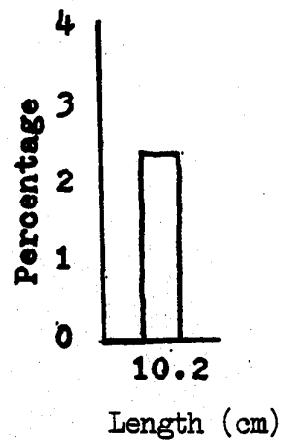


Figure 24c Acanthurus dussumieri  
sizes of Transect Five

n = 6, 2.5% of 244



8 Acanthurus triostegus

Figure 25a Combined count of  
Acanthurus triostegus sizes

n = 29, 2.5% of 1,159

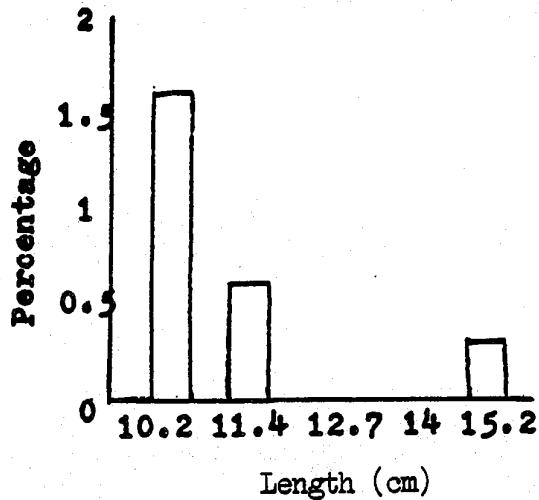


Figure 25b Acanthurus triostegus  
sizes of Transect One

n = 19, 4.2% of 451

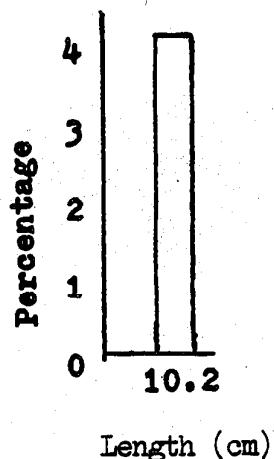
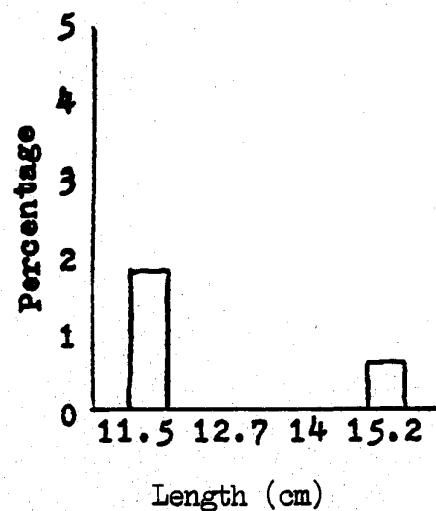


Figure 25c Acanthurus triostegus  
sizes of Transect Four

n = 10, 2.2% of 464



9 Pervagor spilosoma

Figure 26a Combined count of  
Pervagor spilosoma sizes

n = 44, 3.8% of 1,159

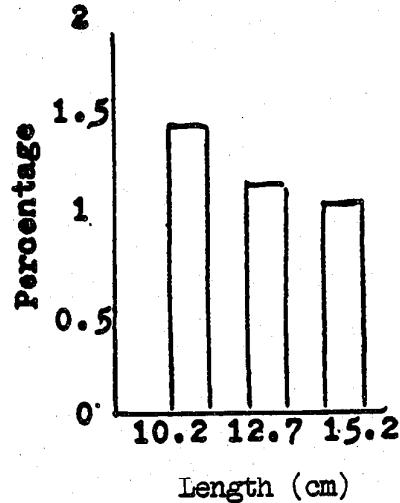


Figure 26b Pervagor spilosoma  
sizes of Transect One

n = 14, 3.1% of 451

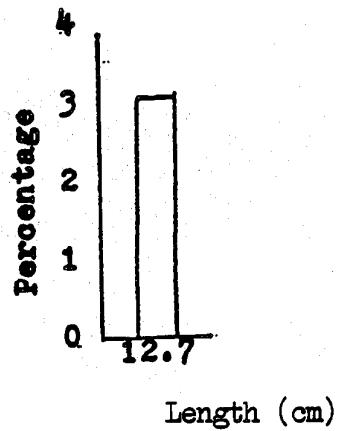
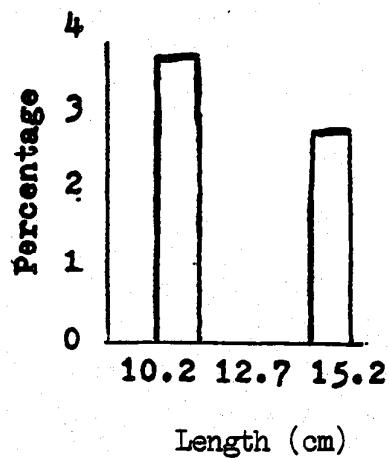


Figure 26c Pervagor spilosoma  
sizes of Transect Four

n = 30, 6.5% of 464



10 Melichthys niger

Figure 27a Combined count of Melichthys niger sizes

$n = 25$ , 2.2% of 1,159

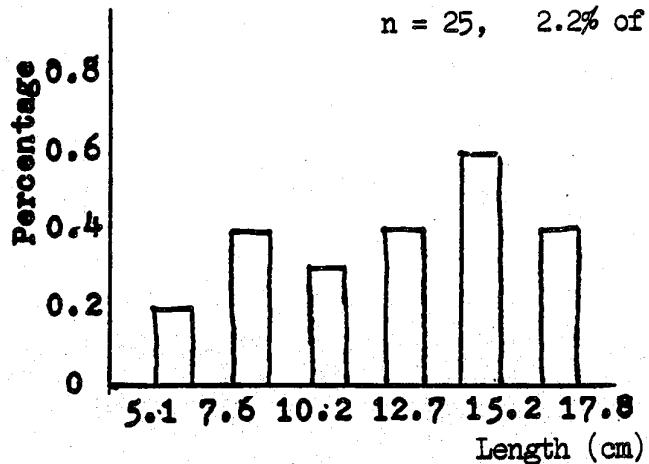


Figure 27b Melichthys niger sizes of Transect One

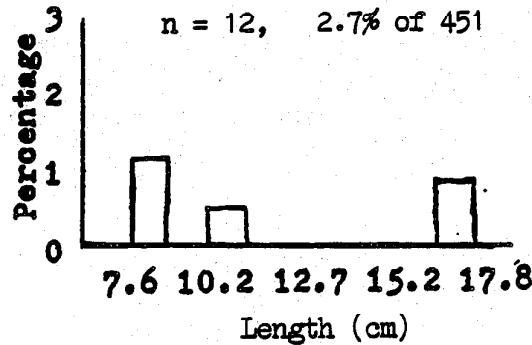


Figure 27c  
Melichthys niger sizes  
of Transect Four

$n = 5$ , 1% of 464

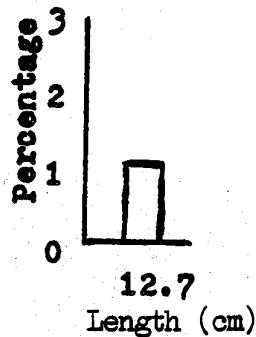
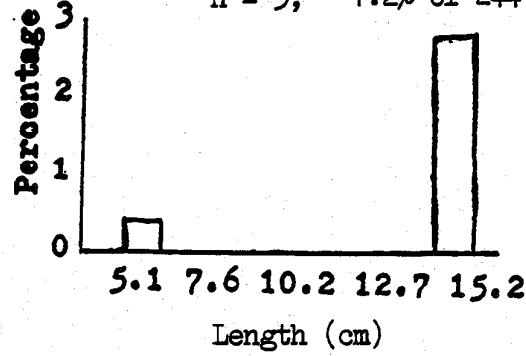


Figure 27d  
Melichthys niger sizes  
of Transect Five

$n = 3$ , 1.2% of 244



11 Parupeneus multifasciatus

Figure 28a Combined count of Parupeneus multifasciatus sizes

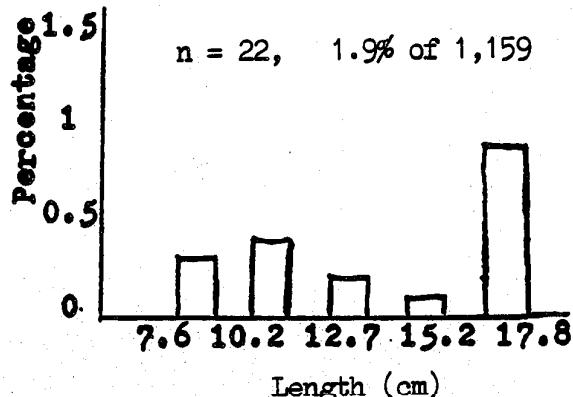


Figure 28b

Parupeneus multifasciatus sizes along Transect One

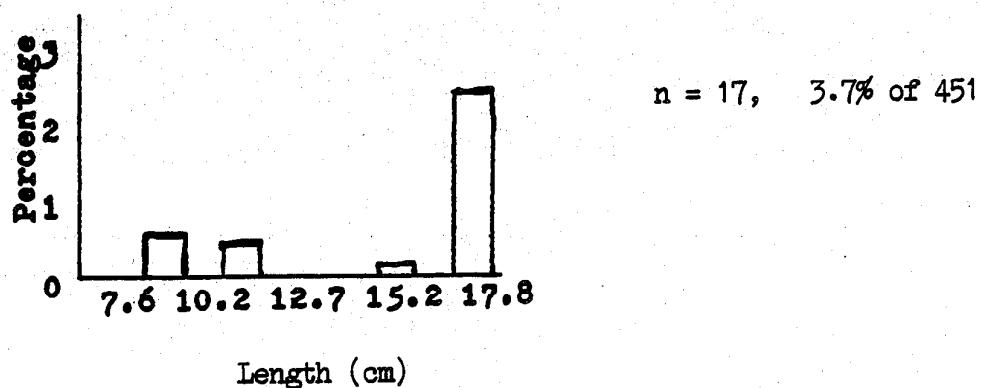


Figure 28c  
Parupeneus multifasciatus  
sizes of Transect Four

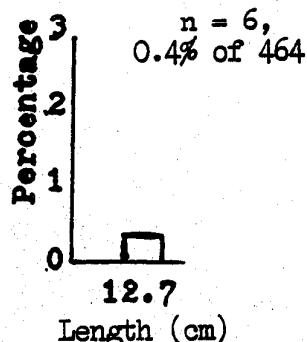
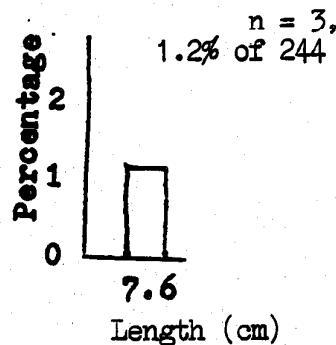


Figure 28d  
Parupeneus multifasciatus  
sizes of Transect Five



12 Naso lituratus

Figure 29a Combined count of Naso lituratus sizes

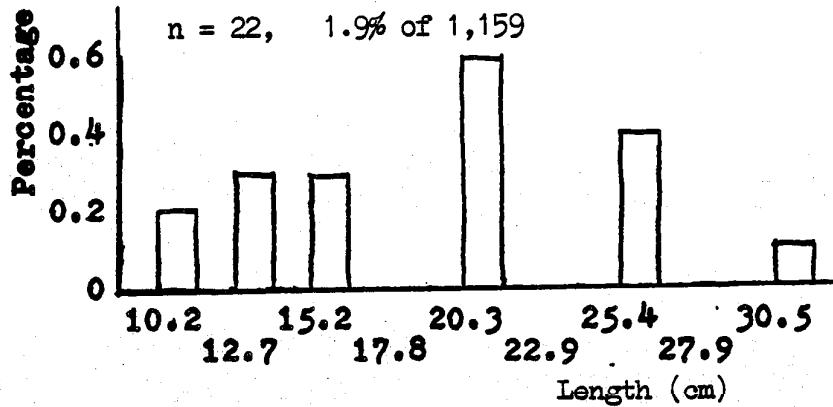


Figure 29b  
Naso lituratus sizes  
of Transect One

n = 17,  
3.8% of 451

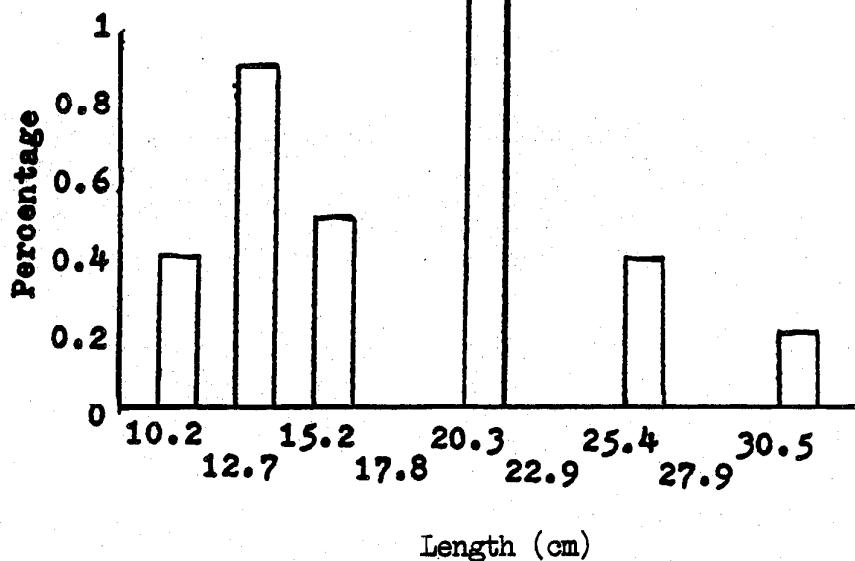
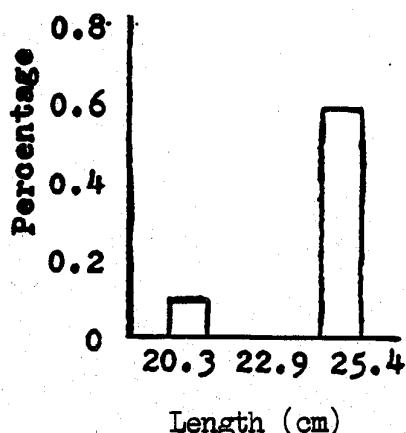


Figure 29c  
Naso lituratus sizes  
of Transect Five

n = 5,  
2% of 244



13 *Stethojulis balteata*

Figure 30a Combined count of *Stethojulis balteata* sizes

$n = 20, 1.7\% \text{ of } 1,159$

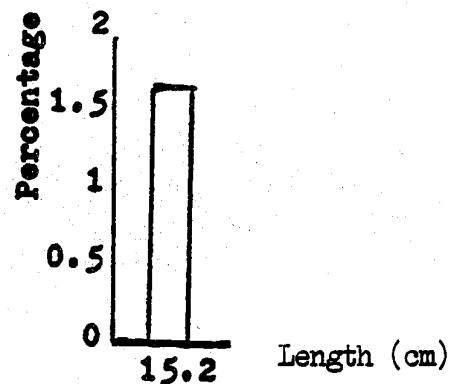
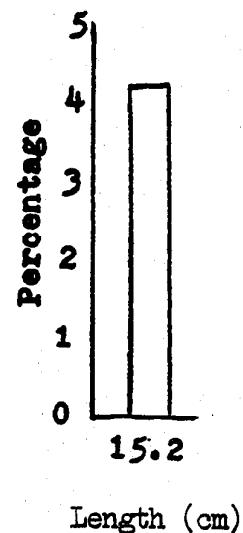


Figure 30b *Stethojulis balteata* sizes of Transect Four

$n = 20, 4.3\% \text{ of } 464$



14 Chaetodon ornatus

Figure 31a Combined count of  
Chaetodon ornatus sizes

$n = 20$ , 1.7% of 1,159

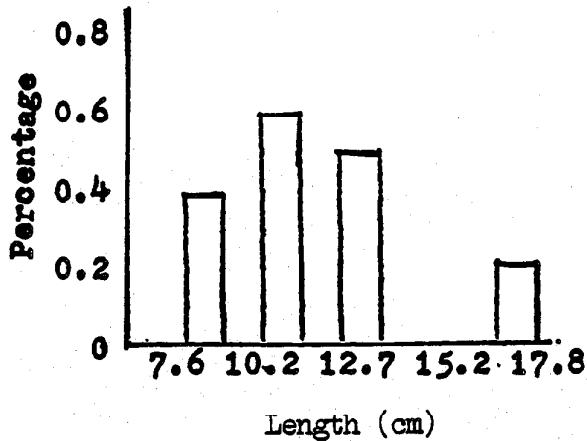


Figure 31b Chaetodon ornatus  
sizes of Transect One

$n = 9$ , 2% of 451

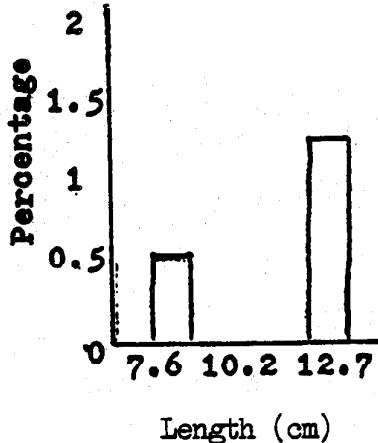
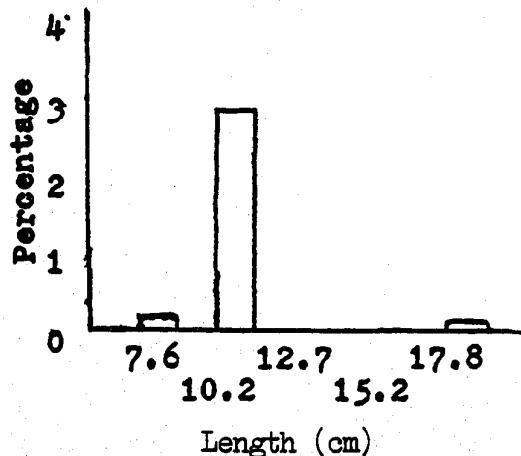


Figure 31c Chaetodon ornatus  
sizes of Transect Five

$n = 11$ , 4.5% of 244



15 *Chaetodon multicinctus*

Figure 32a Combined count of  
*Chaetodon multicinctus* sizes

n = 19, 1.6% of 1,159

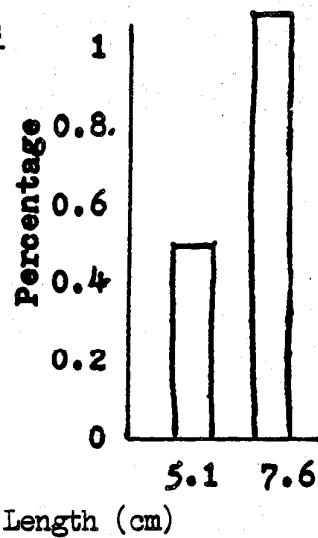


Figure 32b

*Chaetodon multicinctus*  
sizes of Transect One

n = 2, 0.4% of 451

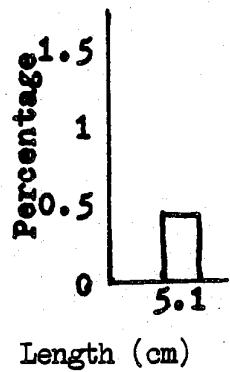


Figure 32c  
*Chaetodon multicinctus* sizes  
of Transect Four

n = 9, 1.9% of 464

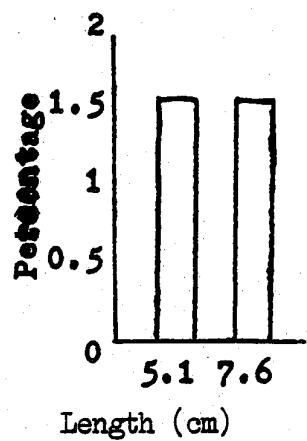
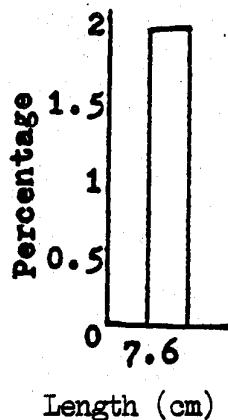


Figure 32d  
*Chaetodon multicinctus*  
sizes of Transect Five

n = 8, 3.3% of 244

16 Kyphosus bigibbus

Figure 33a Combined count of Kyphosus bigibbus sizes

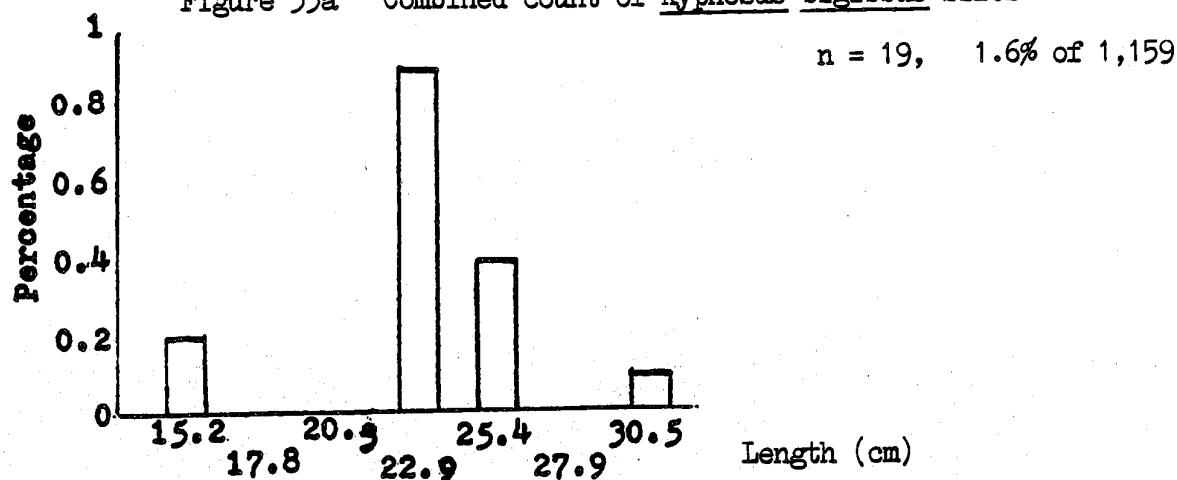


Figure 33b Kyphosus bigibbus sizes of Transect One

n = 11, 2.4% of 451

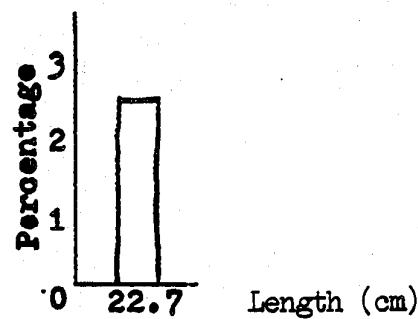
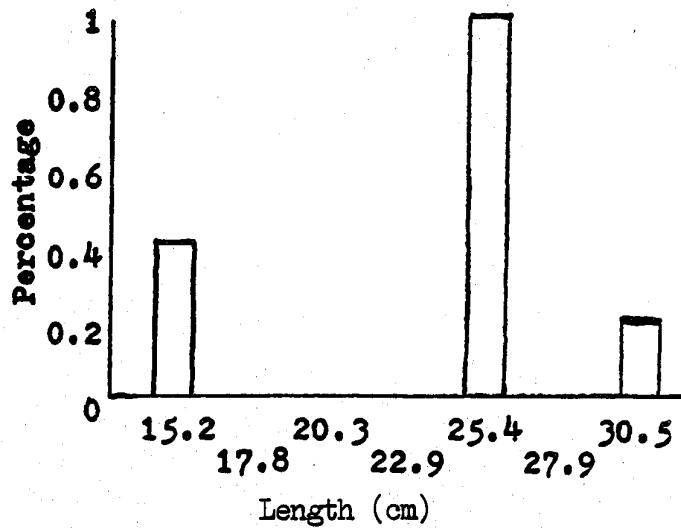


Figure 33c Kyphosus bigibbus sizes of Transect Four

n = 7, 1.5% of 464



17 Acanthurus achilles

Figure 34a Combined count of Acanthurus achilles sizes

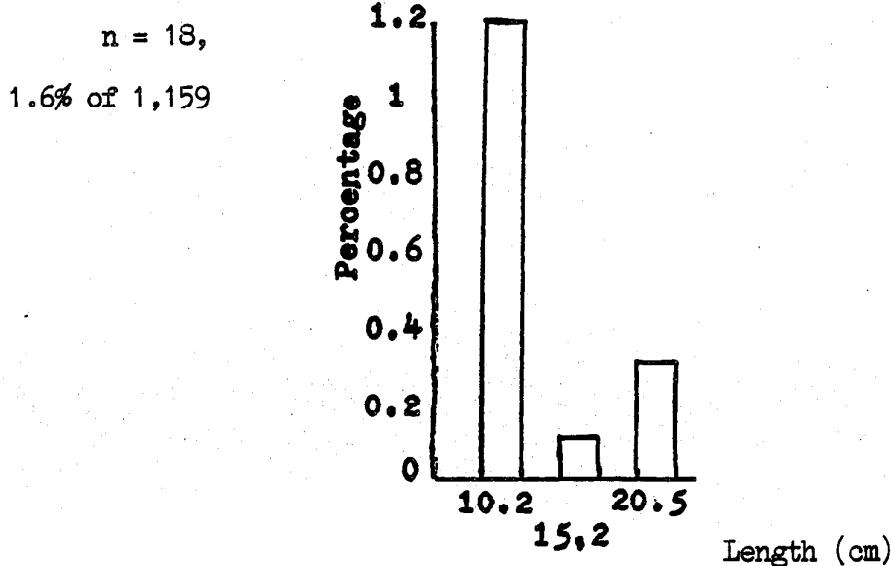


Figure 34b Acanthurus achilles  
sizes of Transect One

$n = 1$ , 0.2% of 451

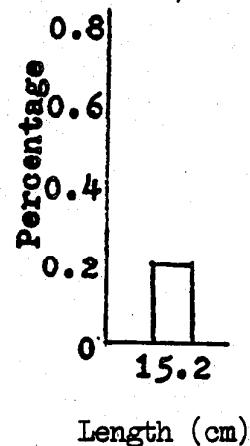
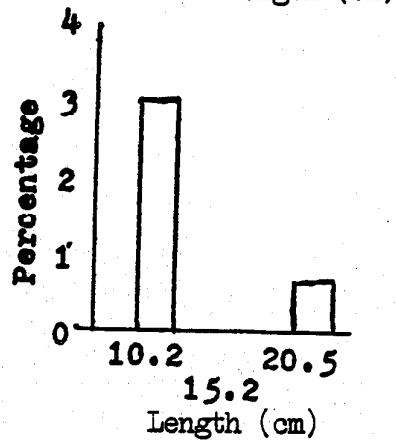
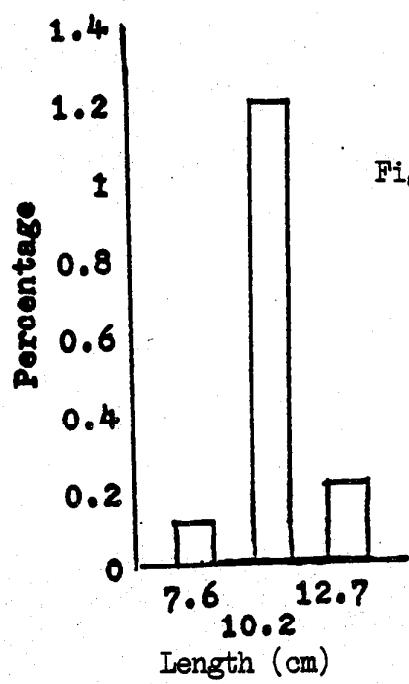


Figure 34c Acanthurus achilles  
sizes of Transect Four

$n = 17$ , 3.7% of 464





18 Gomphosus varius  
Figure 35a Combined count of  
Gomphosus varius sizes

n = 18, 1.6% of 1,159

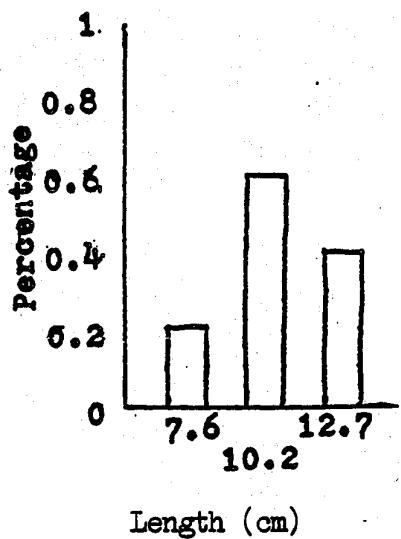


Figure 35c  
Gomphosus varius sizes  
of Transect Four

n = 6, 1.3% of 464

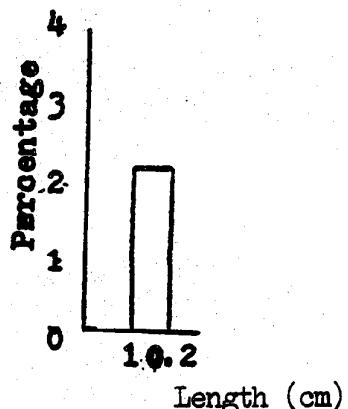
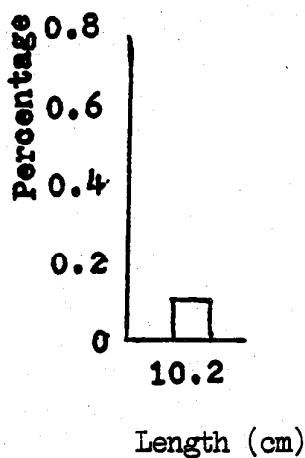


Figure 35d  
Gomphosus varius sizes  
of Transect Five

n = 2, 0.1% of 244



19 Acanthurus nigroris

Figure 36a Combined count of  
Acanthurus nigroris sizes

$n = 15$ , 1.3% of 1,159

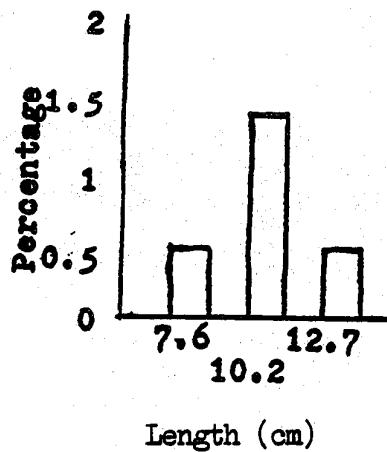
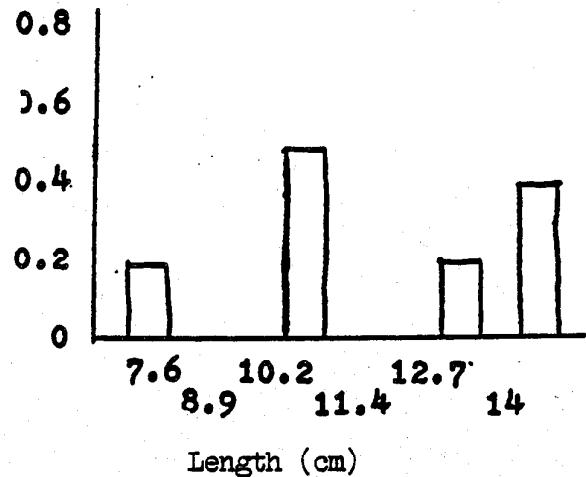
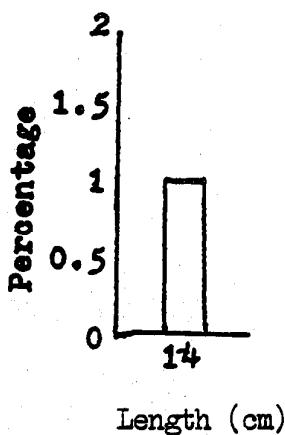


Figure 36b Acanthurus nigroris  
sizes of Transect One

$n = 10$ , 2.2% of 451

Figure 36c Acanthurus nigroris  
sizes of Transect Four

$n = 6$ , 1.3% of 464



20 *Scarus* spp.

Figure 37a Combined count of *Scarus* spp. sizes

$n = 12$ , 1% of 1,159

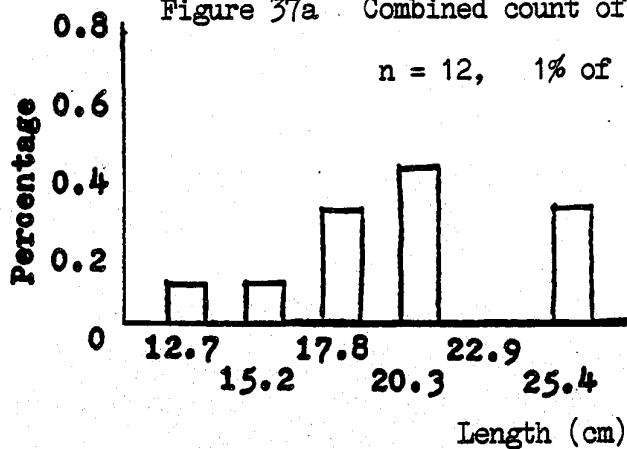


Figure 37b *Scarus* spp. sizes of Transect One

$n = 6$ , 1.3% of 451

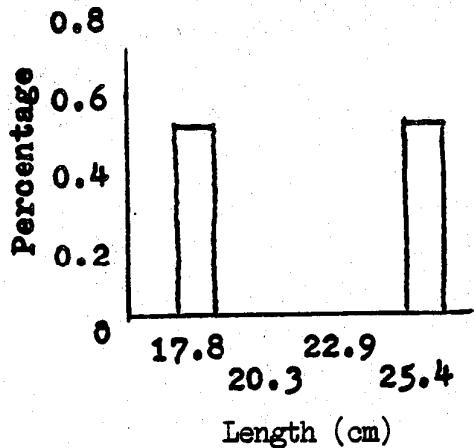


Figure 37c

*Scarus* spp. sizes  
of Transect Four

$n = 5$ , 1% of 464

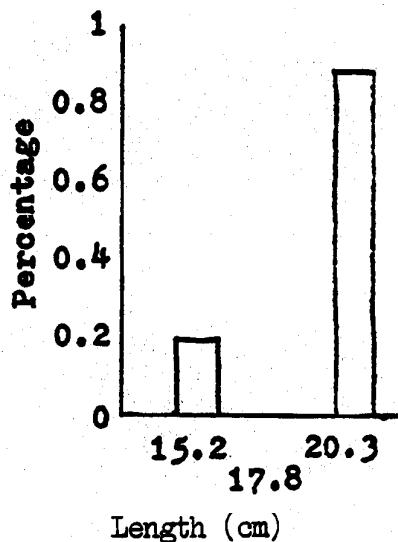
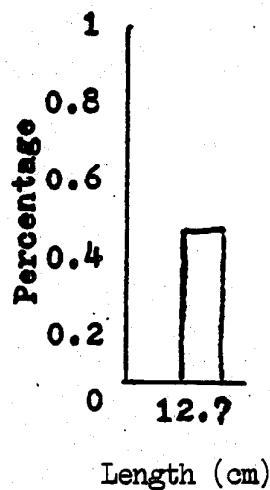


Figure 37d  
*Scarus* spp. sizes  
of Transect Five

$n = 1$ , 0.4% of 244



21 Acanthurus mata

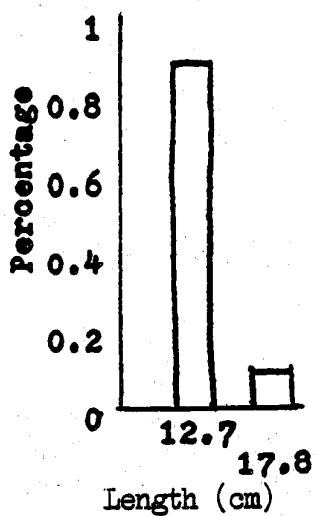


Figure 38a

Combined count of  
Acanthurus mata sizes

$n = 12$ , 1% of 1,159

Figure 38b

Acanthurus Mata of Transect Four

$n = 11$ , 2.4% of 464

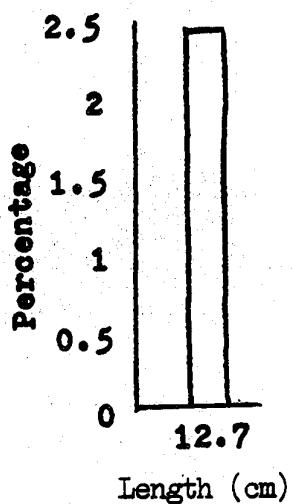
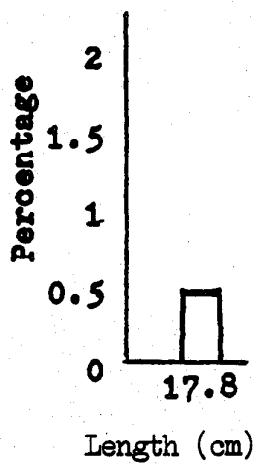


Figure 38c

Acanthurus mata sizes of Transect Five

$n = 1$ , 0.4% of 244



22 Acanthurus olivaceus

Figure 39a Combined count of Acanthurus olivaceus sizes

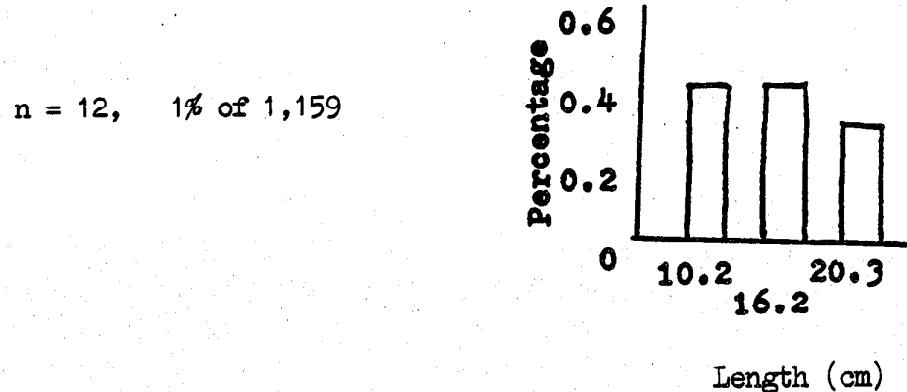
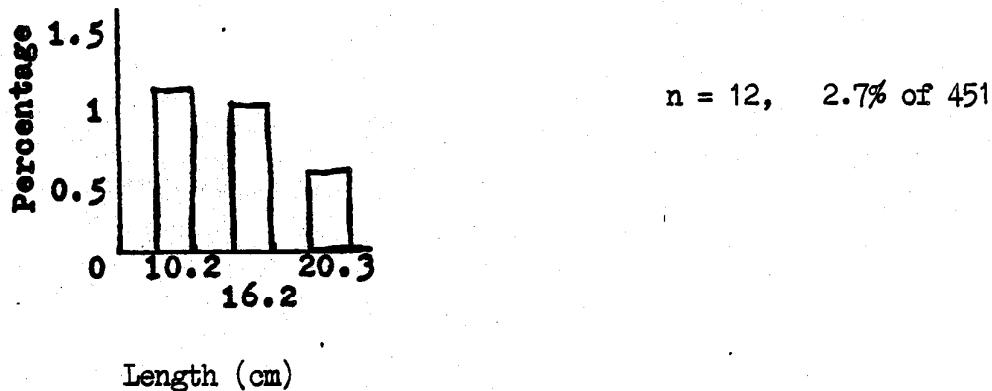


Figure 39b Acanthurus olivaceus sizes of Transect One



23 Kuhlia sandvicensis

Figure 40a Combined count of Kuhlia sandvicensis sizes

$n = 12$ , 1% of 1,159

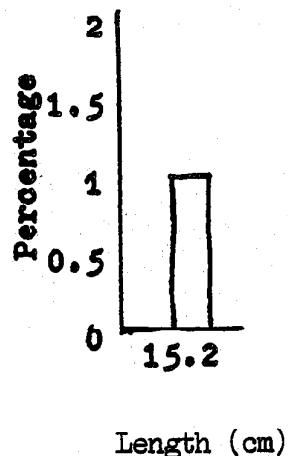
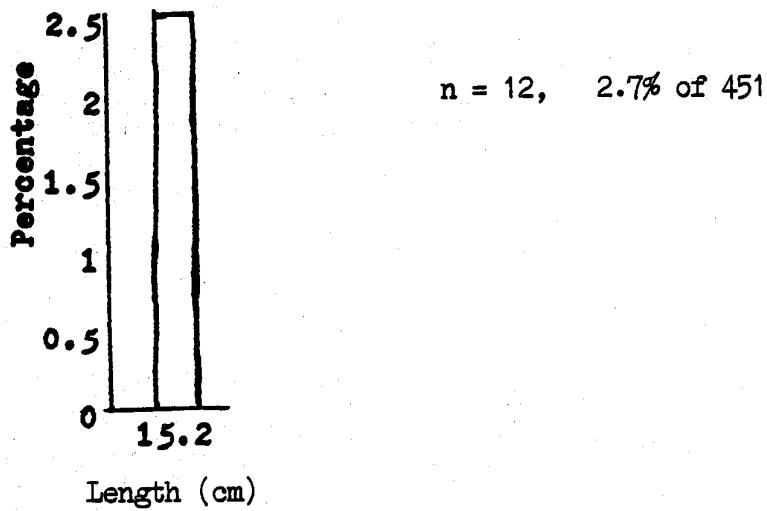


Figure 40b Kuhlia sandvicensis sizes of Transect One



24 Naso spp.

Figure 41a Combined count of Naso spp. sizes

$n = 10, 0.9\% \text{ of } 1,159$

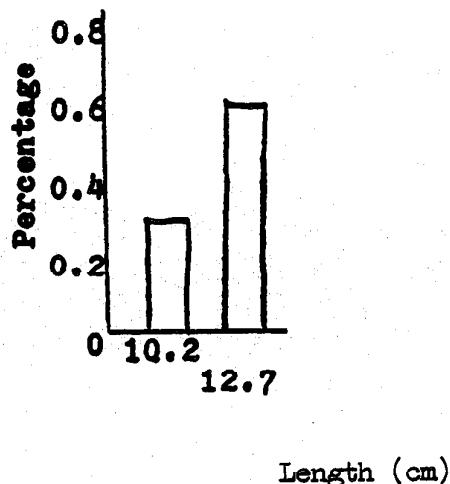
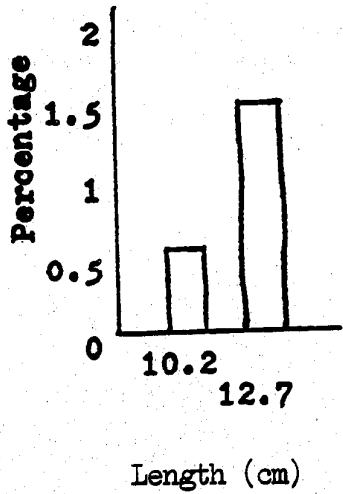


Figure 41b Naso spp. sizes along Transect Four



$n = 10, 2.2\% \text{ of } 464$

25 Mulloides flavolineatus

Figure 42a Combined count of  
Mulloides flavolineatus sizes

n = 10, 0.9% of 1,159

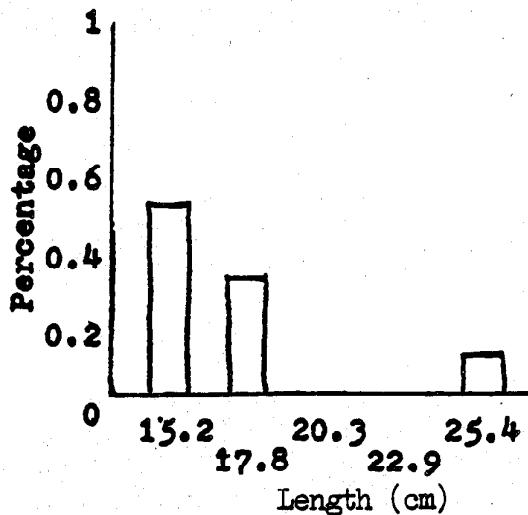


Figure 42b Mulloides flavolineatus  
sizes of Transect One

n = 4, 0.9% of 451

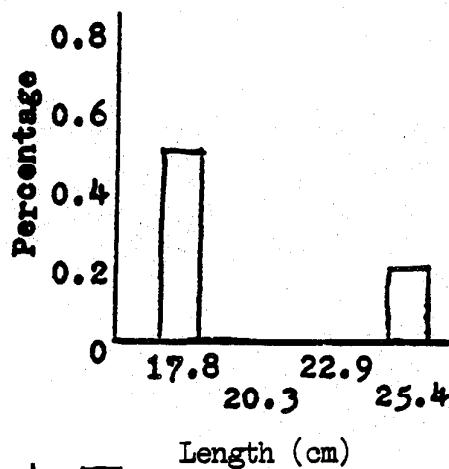


Figure 42c Mulloides flavolineatus  
sizes of Transect Four

n = 6, 1.3% of 464

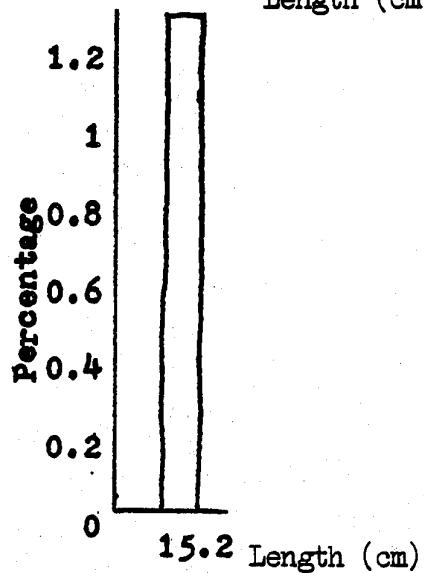


Table 11 Less Abundant Fish Observed and Sized in Ahihi Bay

	Species	Number Observed	Observed Size
26	<u>Canthigaster jactator</u>	9	2.5 to 5.1 cm long
27	<u>Parupeneus plurastigma</u>	8	15.2 cm long
28	<u>Chaetodon unimaculatus</u>	8	7.6 to 10.2 cm long
29	<u>Melichthys vidua</u>	8	15.2 to 20.3 cm long
30	<u>Paracirrhites arcatus</u>	8	5.1 to 7.6 cm long
31	<u>Chaetodon auriga</u>	7	12.7 cm long
32	<u>Acanthurius leucopareius</u>	6	10.2 to 17.8 cm long
33	<u>Thallasoma purpureum</u>	6	7.6 to 17.8 cm long
34	<u>Chaetodon hanui</u>	5	2.5 to 7.6 cm long
35	<u>Forcipinger spp.</u>	5	10.2 to 15.2 cm long
36	<u>Abudefduf sindonis</u>	4	7.6 cm long
37	<u>Centropyge potteri</u>	4	12.7 to 15.2 cm long
38	<u>Thalassoma balleui</u>	4	10.2 to 30.4 cm long
39	<u>Ostracion meleagris</u>	3	5.1 cm long
40	<u>Scarus dubius</u>	3	12.7 to 15.2 cm long
41	<u>Scarus perspicillatus</u>	3	12.7 to 60.9 cm long
42	<u>Rhinecanthes rectangulus</u>	3	12.7 cm long
43	<u>Zanclus cornutus</u>	2	7.6 cm long
44	<u>Labroides phthirophagus</u>	2	2.5 to 5.1 cm long
45	<u>Coris gaimard</u>	2	7.6 to 10.2 cm long
46	<u>Chaetodon quadrimaculatus</u>	2	10.2 cm long
47	<u>Canthigaster amboiensis</u>	2	7.6 cm long
48	<u>Abudefduf sordidus</u>	2	10.2 cm long
49	<u>Coris venusta</u>	1	10.2 cm long
50	<u>Aulostoma chinensis</u>	1	30.5 cm long
51	<u>Chaetodon miliaris</u>	1	7.6 cm long
52	<u>Parupeneus bifasciatus</u>	1	12.7 cm long
53	<u>Chromis vanderbilti</u>	1	5.2 cm long
54	<u>Diodon histrix</u>	1	30.5 cm long
55	<u>Gymnomuraena zebra</u>	1	60 cm long

## CONCLUSION

Within Ahihi Bay, five transect zones were selected and established. The depth range of those transects was zero to 28 feet deep. The depth profiles of those transects illustrate not only the reef flat and ridge, but also the typical spur and groove configuration of the outer reef.

The reef substrates were limestone/rubble (51.64%), live coral (25.82%), sand (10%) and calcareous algae (4.34%) according to the point quadrat method. However, according to the grid quadrat method, coral cover was 16.4 per cent. The two dominant corals were Porites lobata (5.9% of total cover), found in shallow areas with high surf intensity, and Pavona varians (5.12% of total cover). Ten species of coral were sighted.

1,970 fishes of 66 species were observed. The five most abundant fish made up 55% of the total. They were; Ctenochaetus strigosis (18.12%), Zebrasoma flavescens (11.47%), Thalassoma duperrey (11.12%), Acanthurus triostegus (8.38%) and Stegastes fasciolatus (5.33%). Fish sizes were recorded and graphed for three of the five transects.

This has been a good experience for the members of the survey team. For instance, some of the students now know that they need to be more thorough and neat when recording field data. We regret that some of this data has been omitted.

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